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MANPOWER IMPACT ASSESSMENT MODEL (MIAM): AN ANALYTIC MODEL FOR ASSESSING THE EFFECT OF SUPPLY POLICY CHANGES ON MANPOWER REQUIREMENTS AT RETAIL SUPPLY ACTIVITIES

THESIS

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THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

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The contents of the document are technically accurate, and no sensitive items, detrimental ideas, or deleterious information are contained therein. Furthermore, the views expressed in the document are those of the author(s) and do not necessarily reflect the views of the School of Systems and Logistics, the Air University, the United States Air Force, or the Department of Defense.

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Abstract

This research effort proposes an analytic model which evaluates the impact of policy decisions on manpower requirements in a typical Standard Base Supply System (SBSS). This innovative and unique model is the first to integrate Air ~~Force~~ Manpower Standards and workload factors in order to provide objective data for decision-making.

The Manpower Impact Assessment Model (MIAM) gives the decision maker three advantages he has not previously enjoyed. First is the capability to predict manpower requirements objectively. This allows implementation of policy changes to coincide with manpower availability by eliminating the need for a lengthy manpower requirement assessment. Further, this objective prediction also permits the decision maker to redistribute manpower if policy implementation cannot be delayed in order to coincide with manpower availability.

The MIAM's second advantage is the incorporation of a sensitivity analysis as a part of the model output. As one of a few models with this significant capability, the MIAM allows the decision maker to evaluate the sensitivity of the model output as a function of the degree of uncertainty in the input value. Hence, more emphasis can be placed on data collection

processes involving the variables having a high degree of uncertainty if they significantly affect the model output.

Additionally, ~~the~~ MIAM provides virtually immediate feedback on changes in manpower requirements. This represents a drastic savings in time and manpower evaluation resources currently expended. Finally, it increases dramatically the decision maker's flexibility when considering various alternatives.

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I. Introduction

Overall Issue

Certified manpower authorizations and actual manpower requirements are seldom, if ever, perfectly matched. Even though the manning standards are usually accurate assessments of the manpower required to perform a specific mission, the application of those standards and actual assignment of personnel generally lag far behind the changes in requirement. By the time that manning levels catch up with requirements, the mission has often changed again causing either another shortage or a wasteful overage in manning.

A change in the requirement can be caused by a variety of factors such as a change in stockage policy or implementation of automated warehousing. Most of these factors are controlled by the Directorate of Supply in the various major commands (MAJCOM) and the Air Staff. Therefore, careful consideration of the possible effects on manning requirements must be given to all decisions made at those levels, but at present this consideration is primarily subjective. Further,

it is only after implementation of a change are objective data available to evaluate the decision's impact on manpower. To enhance the effectiveness of these decisions, a method of objectively determining the possible effects of such decisions on manpower requirements and distribution prior to implementation is required.

Specific Problem

Currently, changes are made to the Standard Base Supply System (SBSS) without objectively examining their influence on other tasks or responsiveness to customer needs. Many directed policy changes (i.e., Intransit Control Procedures, Line Item Accounting, and Individual Equipment Unit Control Procedures) could have been better developed or analyzed if an objective method of determining their approximate effect on manpower requirements existed. Consider the following example.

Prior to the revision of the Individual Equipment Unit (IEU) control procedures, the IEU of the 410th Supply Squadron at K. I. Sawyer AFB, Michigan, was authorized one staff sergeant, one sergeant, and four airmen. Post implementation, the requirement rose to one staff sergeant, two sergeants, and six airmen. The problem in this particular case was not that more personnel were required to do the same job, but that (1) it was nearly fifteen months before the manpower standard for the IEU was revised and reapplied; and (2) once reapplied, it took approximately twenty-four more

months for the funding request for the increased manpower to flow through the Program Objective Memorandum (POM) cycle. This made the total time between implementation and arrival on station of additional personnel something in excess of three years. This time lag limited the ability of the squadron to effectively accomplish the change and seriously strained the squadron's entire customer support system.

The ultimate objective of this research effort is not to question the need or logic behind decisions such as the one cited above, but to insure that our senior supply managers have a tool to measure objectively the effect such decisions may have on the personnel requirements of the retail level supply systems.

Research Question

Can a model be developed that will allow supply managers to evaluate the impact of specific policy or procedural changes on retail supply manpower resources?

Objective

Develop a model that will determine the impact of specific policy changes in the supply arena on retail supply manpower requirements.

Scope

This research is directed toward the development of a manpower forecasting model for the Standard Base Supply System (SBSS). The SBSS is generally composed of seven

branches: Customer Support, Materiel Storage and Distribution, Materiel Management, Management and Procedures, Supply Systems, Fuels, and Administration (see Figure 1). The Fuels Branch is excluded from this research since the factors that affect their manpower requirement are different from those affecting the rest of the SBSS. That is, their requirements are driven primarily by the flying mission rather than by any internal manipulation of the SBSS. The Administration Branch is excluded because, like the Fuels Branch, its manning requirements are based on factors not directly associated with supply activity. The Automated Data Processing Machine Unit (Supply Systems Branch) is excluded because its manning is based on factors that are arbitrarily determined at the base level. Further, the ongoing installation of the Phase IV computer system is causing a great deal of turbulence in this area.

The following four work centers are also excluded since there are no uniform manpower standards that can be applied to their activities. Each MAJCOM sets different standards for these activities depending on varying mission requirements.

1. Special Asset Management Section (Materiel Management Branch)
2. Repair Cycle Support Unit (Customer Support Branch)
3. Supply Points (Customer Support Branch)
4. Forward Warehouse (Customer Support Branch)

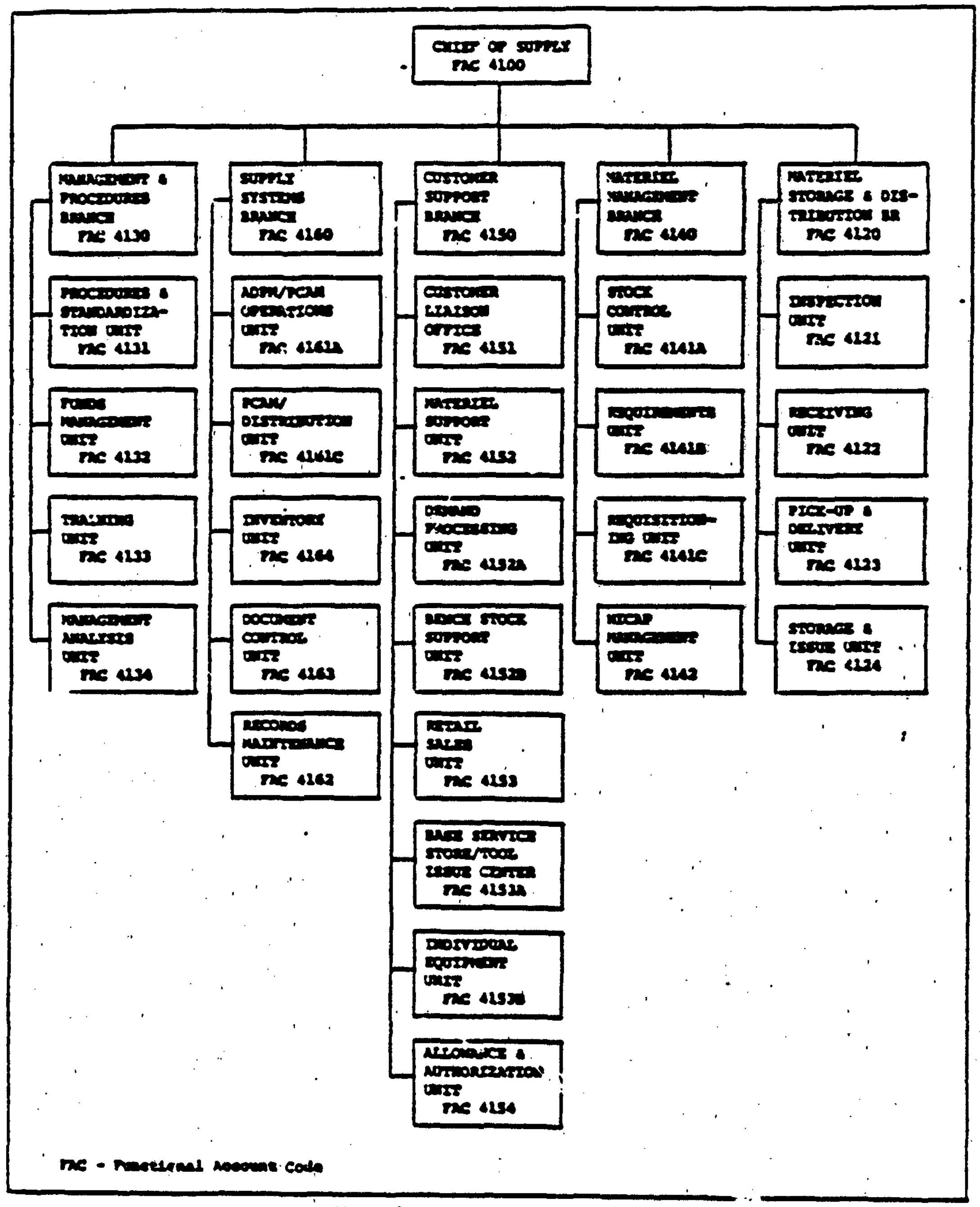

Figure 1. Standard Base Supply System

II. Literature Review

Introduction

The literature review for this thesis uses the resources of the Air Force Institute of Technology libraries, the Defense Technical Information Center, and the Defense Logistics Studies Information Exchange. The purpose of the review is to provide a foundation of knowledge for the proper selection and development of a model that predicts manpower requirements.

The scope of this review is limited to the aforementioned areas since neither time nor the breadth of this research effort lend themselves to a more exhaustive study.

This effort is a broad review of the literature available in the area of interest and is organized to cover the specific areas pertinent to the research topic.

In order to enhance the reader's understanding of the following review, two basic terms are defined:

Systems Analysis--"The organized step-by-step study of the detailed procedures for the collection, manipulation and evaluation of data about an organization [50:341]." The purpose of the study is to determine not only what must be done but also to ascertain the best way to improve the functioning system as a whole.

Operations Research--"A systems approach to problem-solving, using a set of mathematical techniques for the

management of organizations. Also, the application of scientific methods, of mathematical and statistical techniques, and of other tools to problems involving the operations of systems so as to provide those in control of the operations with optimum solutions to problems [50:341]."

It should be recognized that a complete literature review for the thesis topic would be far more extensive, and that this effort constitutes only a part of the overall work. However, this review provides ample background for the completion of the research task at hand.

General Review of the Literature

Modeling and Simulation Theory. "Systems analysis encompasses many techniques useful in the evaluation of complex systems [48:23]." This portion of the literature review covers the types, traits, functions, treatment of time, advantages and disadvantages, and verification and validation of models.

Types. Models are typed according to the method used, the kind of system being evaluated, or the name of the model's originator (48:24). Some of the model types identified include waiting line (queing), critical path (CPM), program evaluation and review technique (PERT), replacement (age, block, blind, sudden, and gradual), transportation, assignment (Hungarian), heuristic, analog, iconic, behavior, Markov analysis, mathematical (symbolic), allocation (graphical,

linear, and nonlinear), gaming, optimization (LaGrangian), goal programming, physical, forecasting, deterministic (analytical), and stochastic (48:24; 1:3-14; 36:620-635; 3:10; 52:8-10; 53).

Shannon aptly sums up any discussion of model types by stating, "In trying to model a complex system, the researcher will usually resort to a combination of pure types [52:10]."

Traits. A good model has all or most of the following traits:

1. Easily understandable
2. A definite goal or purpose
3. Simple operation
4. Simple construction
5. Easily updated or modified
6. A complete treatment of pertinent variables
7. Flexibility
8. Credibility (50:26; 53; 38:691; 40:304; 51:101; 52:22).

Functions. "The concept of representing some object, system, or idea with a model is so general that it is difficult to classify all the functions that models fulfill [52:5]." However, the following list summarizes the functions most commonly cited by the authors reviewed:

1. Support of the decision-making process
2. As an aid to problem identification

3. Forecasting

4. Evaluation of alternatives

5. System analysis

6. Training (3:8-9; 37:10; 39:304; 42:13; 46:139; 52:5-6; 53; 47:8; 48:24; 36:27-59; 1:3-14).

Treatment of Time. Another critical aspect of the modeling process is the treatment of the time dimension. Time cannot be ignored and, in fact, will be modeled regardless of whether or not the modeler consciously considers its treatment. Time will be either static or dynamic.

The static treatment either ignores or treats as irrelevant the passage of time, whereas the dynamic treatment more closely follows the real-world action of the variables as they vary through time. Static models are described as a single snapshot of the system at a given point in time. Dynamic models are more akin to a moving picture of the system. Dynamic models are superior in most applications due to their closer resemblance to reality, but due to their comparative complexity and cost, dynamic models are vastly outnumbered in actual use by static models. The question of which to use is one the modeler must carefully consider (53; 36:27-59; 1:3-14; 43:34).

Advantages. Most of the advantages of modeling are discussed indirectly in the previous passages. The following list summarizes them:

1. Decision-making assistance

2. Support of the planning process

3. Problem analysis

4. Flexibility

5. Forecasting and prediction (48:29; 3:8; 37:10; 47:7; 52:ix; 1:7-10; 36:33-42; 53).

Shannon summarizes the advantages of modeling thusly,

> Simulation is one of the most powerful analysis tools available to those responsible for the design and operation of complex processes and systems. . . . It allows the user to experiment with systems where it would be impossible or impractical otherwise [52:ix].

Disadvantages. On the other hand, the following disadvantages are noted:

1. The larger the model the more complex it becomes.

2. The more complex it becomes the more difficult it is to understand, update, modify, and operate.

3. As models become complex they become less flexible. It should be noted that this disadvantage can be minimized by using a modular concept to build a model. This technique retains much of the model's flexibility, allows sensitivity analysis of the various modules to be accomplished independently and provides a clearer understanding of the logic flow. Such step-wise refinement simplifies the mathematical as well as the logical development of the model.

4. Models, even simple ones, are often expensive to develop and operate (41:1071; 48:30; 53).

Verification and Validity. Validity in modeling is measured by the degree with which the model represents reality. Verification is the determination that the model's logic is correct. For deterministic or analytic models, verification and validation are nearly synonmous so long as the modeler's symbology accurately represents the system being modeled. For stochastic models, it is a two-step process with validation following verification (48:27; 53; 52:29-30).

Validation is unquestionably the most critical step in the modeling process; for if the model does not accurately represent reality, it is not going to provide useful information to the decision makers.

To achieve validity, the modeler must be thoroughly familiar with the system being modeled and the kind of output its user wants. Most of the authors surveyed agree that the best way to do this is to involve management (users) in the modeling process at the onset and keep them involved throughout the process (42:12; 52:29-30; 48:27).

Smith adds that not only must the modeler involve management in the development of the model, but management must involve the modeler in the implementation of the model. For if there were any errors made in the development of the model or unforeseen changes in the expected range of the variables input to the model, the modeler must be there to correct or adjust them. If the modeler is not involved, the model may

not work, or even worse, it may provide bad information to the decision maker (53).

Conclusion of the General Review. Modeling is one of the decision maker's most powerful tools and will be the primary vehicle used to resolve the problem addressed in this thesis.

Review of Representative Literature

Two specific areas of the literature are reviewed since they are pertinent to this research and also representative of the literature as a whole. The first, corporate modeling, is selected for citation because it is the general form of modeling closest to the intent of the Manpower Impact Assessment Model (MIAM). The Logistics Composite Model is chosen for review because it has been mentioned as a possible source for adaptation to this effort and it is available in the logistics community.

The Corporate Model. The corporate model has evolved as a result of the planner's need for a tool to help him forecast outcomes of various alternative decision strategies. As it became increasingly apparent that manual planning techniques were inadequate to meet the needs of the future, the advent of a rapidly developing computer technology led to computerized corporate simulation models.

The literature generally agrees that corporate models are predictive in nature and are intended to help the planner

deal with the "what if" situation (2:95-96; 45:9-10). Further, there is agreement that planners can usually delineate the

> . . . detailed relationships among corporate policies, resources and company performance. However, managers are unable to determine accurately the dynamic behavior implied by these relationships [44:15]

and the alternatives this behavior presents.

The corporate model offers five major benefits to the planner:

1. Ability to explore more alternatives
2. Better quality decision-making
3. More effective planning
4. Better understanding of business
5. Faster decision-making (45:13; 44:15-17)

The shortcomings of the corporate model are broken down into three primary areas:

1. Lack of flexibility
2. Poor documentation
3. Excessive data requirements (45:13)

Despite these shortcomings, the corporate model is a primary tool in the planner's inventory of techniques for effective planning. The model's ability to provide logical alternatives in the "what if" situation, based on historical data and probabilities, makes it particularly effective when considering any decision that can be expressed in mathematical terms, such as financial projections (45:10; 44:16; 2:95-96).

The Logistics Composite Model (LCOM)

LCOM is designed to provide a mathematical simulation of variable mission scenarios and, thereby, to identify and to forecast maintenance manpower requirements for a new weapon system under those various scenarios. It allows flexibility in the input of operations, maintenance and supply data in order to test a given capability. The impact of changes to various aspects of the weapon system being tested are readily evaluated, making LCOM a dynamic model (49:1-1).

LCOM is composed of three models or programs which are interactive: a preprocessor (input), a main program (simulation), and postprocessor. The language used to develop the model is Simscript I (49:2-1).

The LCOM workbook is put forth to help operations analysts use the model during manpower assessments of new or emerging aircraft weapon systems. It provides a basis of understanding in the model concept, organization, and use. Further, the paper deals in some depth with scenario development, input and output parameters, and analyses of input and output requirements. A documented review of these latter areas was not conducted since they were directed ard the technical expert/user and not toward the generalist seeking a basic knowledge of the model. Therefore, this review limits itself to general information about LCOM contained in the initial chapters of the workbook.

The preprocessor is designed to translate user input data into a form which can be read by the main LCOM program. It also "serves as a sortie generator" (49:2-2). The simulation or main program is designed to depict a wide "range of aircraft operations, scheduling, maintenance and supply function at an Air Force base [49:2-6]." The user of the model determines the "resources of interest" such as types of aircraft and how they are to be used, while the LCOM supplies "the controls and structure to simulate and maintain a record of their action and interaction [49:2-6]."

The LCOM simulates real-life missions in another way in that it aborts those missions which cannot be accomplished as scheduled. A variety of operational reasons, such as the lack of available aircraft due to higher priority missions, may cause these cancellations (49:2-6). The LCOM also simulates post-mission maintenance, including trouble-shooting and debriefing to detect and correct aircraft failures. In this way, the LCOM generates supply demands and reparable parts for maintenance work at base-level or depot-level repair facilities. At this point, it simulates the required maintenance activity based on historical repair data, returning "repaired" items to supply stock (49:2-8).

The LCOM's simulation program has the capability of using specific resources, such as personnel, on a shift basis. The specific application of the resource is determined by the user (49:2-9).

The main program can produce seven different reports ranging from a performance summary through a resource status report to a back order status report for parts on order. These reports require "substantial computer time and can produce great quantities of paper if used too frequently [49:2-9]."

The third program, the postprocessor, produces a "time series of graphs" that can account for a full-scale scenario of missions, including jobs and manpower utilization over a given time period. To keep the user from being inundated by data output, LCOM is designed with "sixty-five aggregate performance statistics [49:2-10]."

A series of manpower matrices in one-half hour increments is designed to give the user a better knowledge of the "actual demands for manpower for each given manpower specialty [49:2-16]." However, manpower, as with all input factors, is not limited to maintenance alone, but includes all the requirements for a complete weapon system (aircraft) test scenario.

LCOM is capable of supporting several models that deal with logistics problems. A prime example is LCOM's support of the Cost of Ownership (COO) Model in determining "manpower costs for new ratios, maintenance, manpower and the adequacy of replenishment spares [49:2-18]."

In the case of manpower requirements, factors such as "availability," crew rest, "squadron integrity," and "special qualifications" have to be considered when inputting flying crew manpower factors into the LCOM model. Similar factors

have to be considered for maintenance manpower inputs; however, supply manpower inputs are not specifically addressed (49:2-20).

Robinson concludes his general discussion of LCOM by breaking the model's limitations down into eight categories:

> 1. Computer storage limitations are variable with the type of computer equipment used and is critical in determining the size of an LCOM simulation.
> 2. No generalized decision method exists which permits one task to be contingent upon another. Thus, the user must determine through a failure resource mechanism (halt clock) as to the probability of a route. Network trickery, or skill and experience in networking is a means of coping with this problem.
> 3. Only a sortie task is permitted to be designed for external control, i.e., take-off time.
> 4. LCOM fails to provide a measure of accuracy for a pause between the act of generating the airplane for the sortie and the next step of the problem, the aircrew preflight. This is an external scheduling limitation.
> 5. LCOM cannot defer maintenance until a block of time becomes available.
> 6. An LCOM simulation is time-consuming in terms of both calendar days and manpower effort.
> 7. LCOM cannot measure mission success.
> 8. LCOM's assessment of battle damage, depot actions and maintenance on AGE is either extremely limited or nonexistent [49:2-21].

The information gained from this paper, while being helpful in the development of modeling ideas, has convinced us that LCOM's basic purpose is different from ours; and, further, its complexity, cost and resource requirements make LCOM impractical to use in this research.

III. Methodology

Since the basic problem and objective of this thesis have already been defined and stated in Chapter I, attention is now focused on the procedures that are used to answer the research question.

The first step toward answering the research question was a review of literature on the topic of modeling. The review was necessary to acquaint us with modeling and to suggest models that could possibly be used in this effort. Ancillary to that was a review of various case studies and research on the topic of modeling to determine manpower requirements in order to discover some approaches that have already been tried and how successful they were in resolving the manpower requirement problem. This review proved to be of limited use since no previous research was found that exactly paralleled the conditions in the system we are endeavoring to model. This research did, however, help in determining an approach to the problem and the scope of the problem.

Model Selection

The research conducted, as documented in Chapter II, indicates that no model exists which accurately portrays the mathematically deterministic relationships between the Standard Base Supply System (SBSS) workload factor statistics and the Air Force Manpower Standards. Since these relationships are almost entirely linear and first order, an analytic

model, the Manpower Impact Assessment Model (MIAM), will be created to portray this system.

Assumptions

Two assumptions are fundamental to the formulation of the Manpower Impact Assessment Model developed in this thesis. The first assumption is that the adjusted workload factor data provided by the Air Force Logistics Management Center (AFLMC) or user are accepted as input for MIAM without qualification since the validation of that data is beyond the scope of this thesis. This assumption is made with the concurrence of the sponsor of this research (AFLMC).

The second assumption critical to this analysis is that the workload factor data for each Standard Base Supply System are independent; that is, the workload at base A has no significant impact on the workload at base B. While there are some possible relationships (i.e., common missions, types of weapon system supported, geographical location), no direct linear dependency pervading this data set exists.

Method of Analysis

The analysis for this research effort begins by focusing on the research question: Can a model be developed that will allow senior supply managers to objectively evaluate the impact of specific policy or procedural changes on retail supply manpower resources?

Shannon describes the simulation modeling process in eleven separate stages. These stages are:

1. System Definition
2. Model Formulation
3. Data Preparation
4. Model Translation
5. Validation (Verification)
6. Strategic Planning
7. Tactical Planning
8. Experimentation
9. Interpretation
10. Implementation
11. Documentation (52:23)

The remainder of this chapter will explain how these stages are implemented in this research. Figure 2 presents a graphic illustration of how the process flows. Since MIAM is a deterministic (analytic) model, Shannon's stages 6, 7, 8 and 9 do not apply. Therefore, our process flows from step 5, validation, to an intermediate step 5a, sensitivity analysis, to step 10, implementation. The final step, documentation of results, will have to be taken up by future researchers since the model is not likely to develop any significant operational history prior to the close out of this research effort.

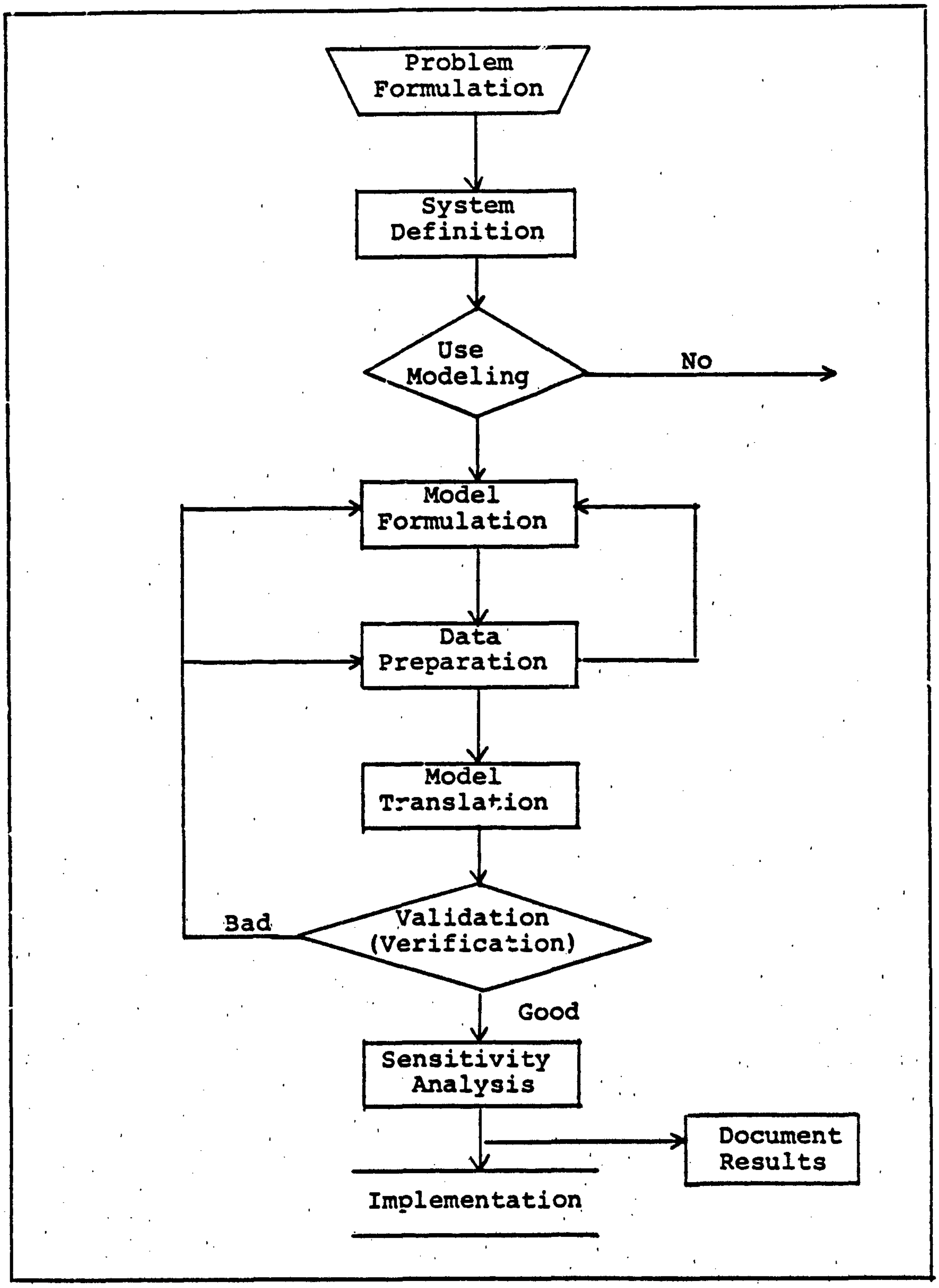

Figure 2. Stages of the Modeling Process

Present System Definition

The present system for making decisions affecting Air Force supply matters can be illustrated in a simple way by dividing it into five major subsystems and discussing briefly the role of each in the overall system. The five major subsystems involved are:

1. Forces outside the system
2. Senior supply managers
3. Policy and procedure changes
4. Standard Base Supply System (SBSS)
5. Changes in manpower requirements

Their role in the decision-making system and an over-simplified statement of the system processes follow.

When forces outside the present decision-making system, such as budget constraints imposed by Congress or time limitations set by higher authorities on the implementation of a weapon system, cause senior supply managers to consider a policy or procedure change, they must make the decisions or changes without objective data on the impact the decisions may have on manpower requirements at the SBSS. The decision makers must rely on the best <u>subjective</u> information available, i.e., their experience and the experience or opinions of others as to the impact their decisions may have on the SBSS. Using this subjective data in conjunction with all other pertinent data, a policy change is directed.

The implementation of the policy change occurs at the SBSS. Here, following implementation of the change, workload statistics are measured and the Air Force Manpower Standards are applied. The required manpower change, if any, is relayed back to the decision makers for action. It should be noted that only after implementation are objective data on a decision's impact on manpower available to decision makers. Figure 3 graphically illustrates the preceding example.

<u>Proposed System Definition</u>

The proposed system remains the same as the present system up to the decision-making point. At this juncture, proposed policy and procedure changes would be forwarded to the model user for evaluation. Using actual workload factor data, the model user would derive average workload factor statistics. At this point, the proposed policy or procedure change, coupled with the average workload factor statistic, are used to predict the workload factor data if the policy is implemented. These predicted data, in conjunction with the average workload factor statistics and Air Force supply manpower standards, are used by the MIAM to estimate the change in manpower requirements for the typical SBSS as a result of the decision (Figure 4). This figure would then be multiplied by the number of SBSSs affected to obtain the aggregate effect.

With this information, the decision whether to implement the change is made. If implementation is the case, this is accomplished at the SBSS.

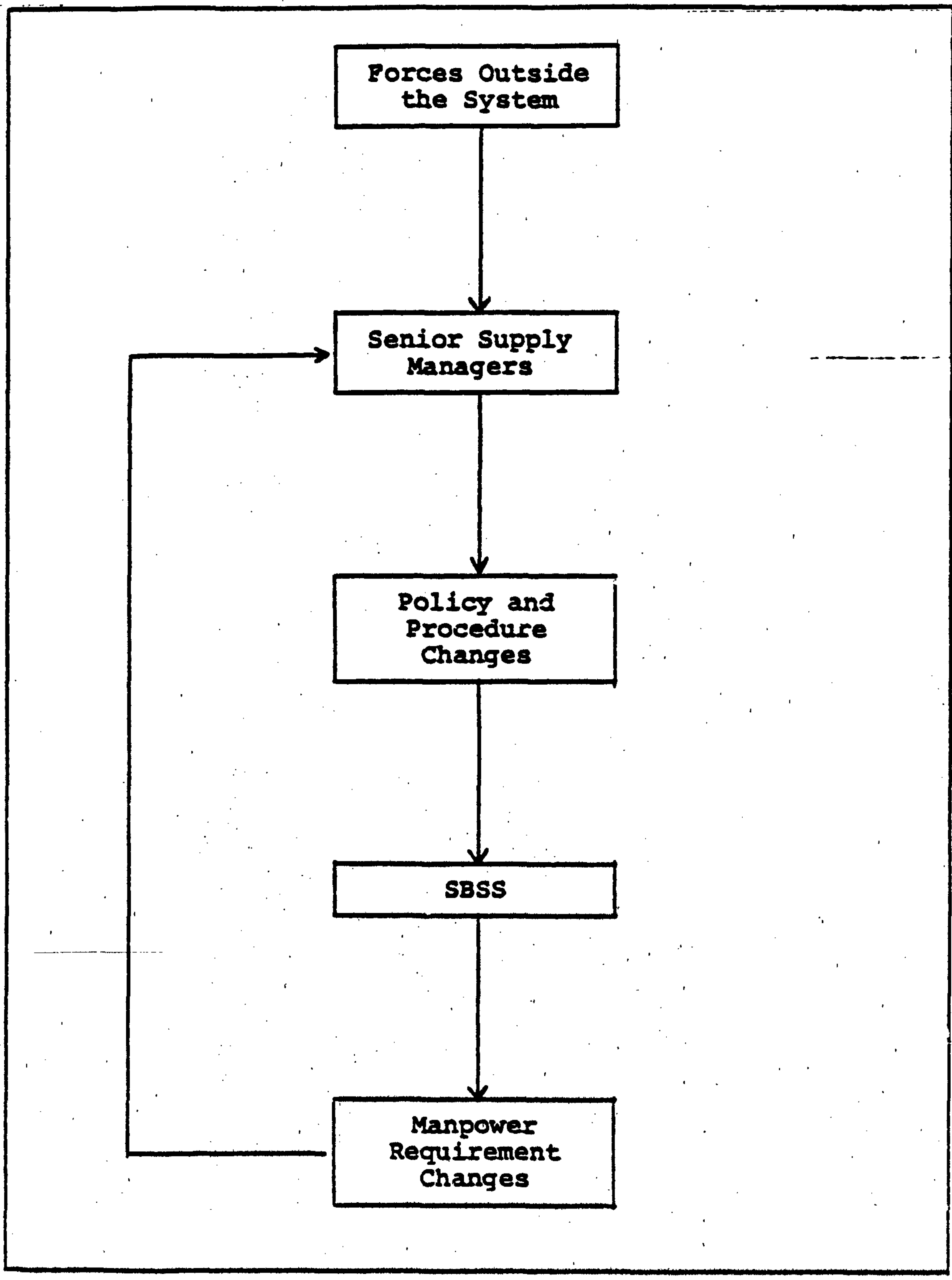

Figure 3. Present System Definition

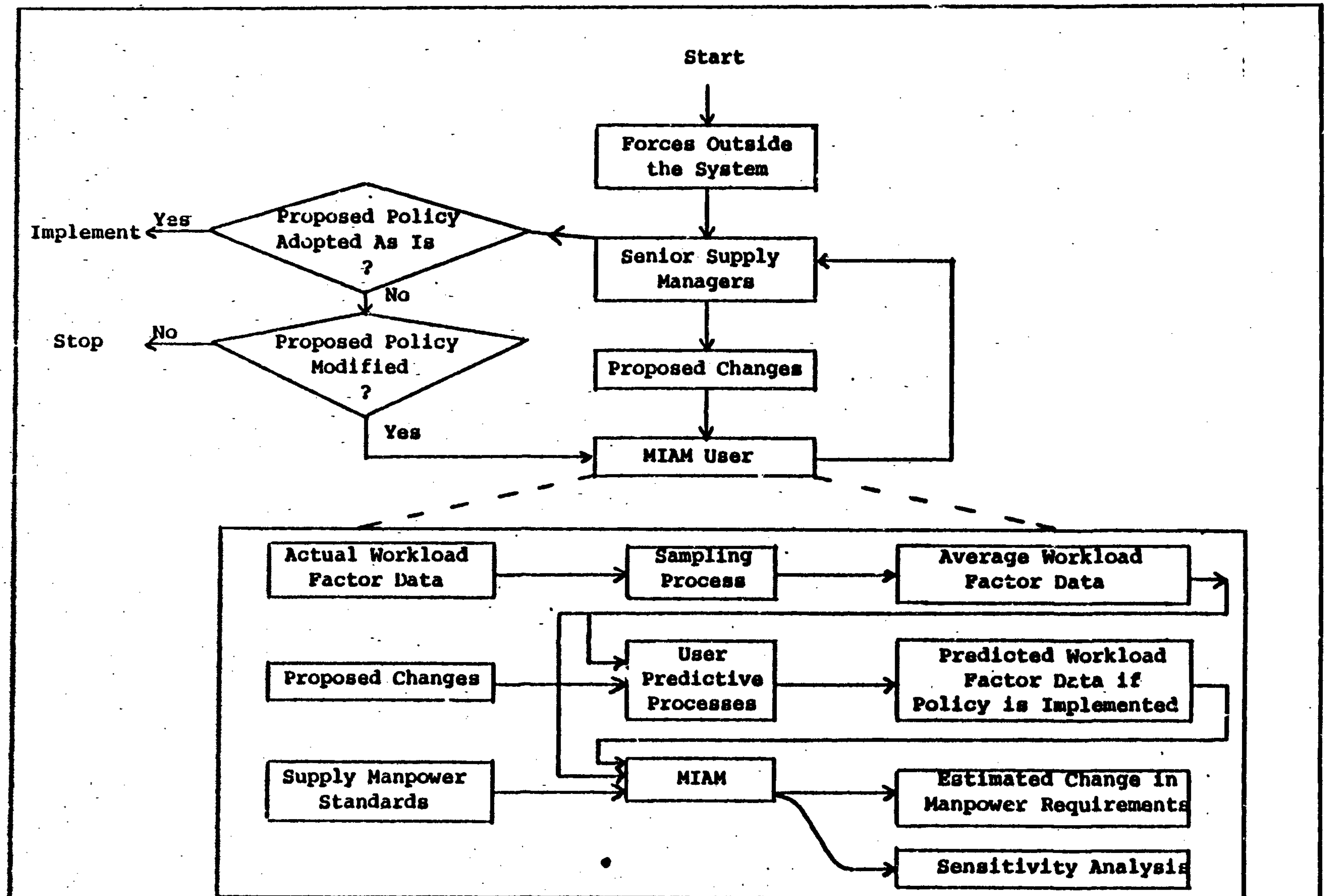

Figure 4. Proposed System Definition

This proposed system has the advantage of allowing implementation to coincide with manpower availability (or reduction) as well as a more accurate estimate of a manpower change since feedback on manpower impact is more objective and timely. Another advantage is that MIAM gives the decision maker an indication of how he might best redistribute his manpower if more practical than getting more authorizations or as an interim measure until additional manpower is available. Additionally, MIAM is one of only a select few models that incorporates a sensitivity analysis to help the decision maker determine how much confidence to put into the output.

Model Formulation

Shannon states that virtually any system can be effectively modeled if the modeler understands the structural building blocks from which models are constructed. "Although a model may be very complicated mathematically or physically, its underlying structure is very simple [52:14]." This structure can be represented mathematically as

$$\varepsilon = f\ (x_i, y_i)$$

where

ε is the effect of the system's performance

x_i are the variables and parameters that we can control

y_i are the variables and parameters that we cannot control

f is the relationship between x_i and y_i that gives rise to ε (52:14)

Since this oversimplification is not much help, the following expanded view is presented and will be used in the formulation of the system model, MIAM.

Every model consists of some combination of the following ingredients:

1. Components
2. Variables
3. Parameters
4. Functional Relationships
5. Constraints
6. Criterion Functions (52:14)

A brief discussion of each of these ingredients as it pertains to the model being developed follows.

Components. Components are "the constituent parts that when taken together make up the system [52:15]." The components (or subsystems) making up the MIAM include:

1. Senior supply managers
2. Proposed supply policies and procedures
3. MIAM user
4. MIAM user's process for estimating workload factor data changes
5. Workload factors for the SBSS
6. Baseline data for the SBSS
7. Air Force Manpower Standards

Variables. There are two types of variables normally found in a model of a system. They are called endogenous and exogenous variables. The endogenous variables are those variables produced within the system (52:15). They include:

1. Policy and procedural changes in the SBSS directed by senior supply managers

2. The workload factor changes which are determined by the model user

The exogenous variables, which are also called input variables, are those variables originating outside of the system. Even though they are critical, they are generally uncontrollable. Therefore, in this case, they will be simply classed as any factor which causes the senior supply managers to see a need to change, modify, delete, or add policy and procedural guidance affecting the SBSS.

Parameters. Parameters are quantities which "can assume only those values that the form of the function makes possible [52:15]." Parameters include, but are not limited to measures of central tendency, such as mean, median, and mode; and measures of variability, such as the range, variance, and standard deviation (52:15). The only parameter in the MIAM is the mean of each workload factor.

Constraints. "Constraints are limitations imposed on the values of the variables or on the way in which resources can be allocated or expended [52:16]." The constraints pertinent to this system include:

1. The Air Force Manpower Budget

2. The Air Force Supply Manpower Standards

The manpower budget limits the amount of increase in the SBSS manning levels, whereas the Air Force Supply Manpower Standards limit the ways in which manpower resources can be allocated.

An important relationship exists between the Air Force manpower budget and the Air Force Manpower Standards. The budget details exactly how much money is available to fund manpower requirements, while the Air Force Manpower Standards take certain workload factors generated by the SBSS and use them to determine authorized manning levels (see Appendix A for a sample illustration of how one is applied). The mere fact that the applied standards indicate that "X" number of supply personnel are needed to effectively operate the Air Force's SBSSs does not guarantee that enough money will be in the budget to man them at that level.

<u>Functional</u> <u>Relationships</u>. "Functional relationships define the way in which variables and parameters behave within the context of the system being defined [52:15]." Shannon points out that these relationships, or operating characteristics, are either deterministic or stochastic in nature. "Deterministic relationships are identities or definitions that relate certain variables or parameters where a process output is uniquely determined by a given input [52:15-16]." In the MIAM the relationships are deterministic.

Inputs to MIAM include a set of average workload factors and a set of adjusted workload factors. These average figures are meant to be close representations of the mean workload factors for each of the categories of SBSS (CONUS/ overseas) being modeled. The user predicts the amount of change to these workload figures if the particular policy or procedure in question is implemented. The actual and adjusted mean workload factors are then input into the MIAM where the Air Force Supply Manpower Standards have been coded to determine the before and after effect the particular policy or procedure will have on manpower requirements. This output is forwarded to senior supply managers who can weigh the benefits to be gained by the policy or procedure in question against the costs in dollars, customer support, and mission effectiveness. The exact form this output will take is detailed in Appendix B.

Criterion Function. "The criterion function is an explicit statement of the objectives or goals of the system or how they are to be evaluated [52:16]." The goal of this system is to provide our senior managers with detailed, objective, and accurate assessments of the effect of a new or revised policy or procedure on retail level supply manpower requirements. More specifically, they are intended to insure that senior managers are made aware of the approximate effect their decisions will have on manpower requirements (either positively or negatively) before a decision is made.

Data Preparation

Two data sets will be needed by the MIAM. The first, the average workload factor data, are taken from actual SBSS workload factor data. These data are sampled and mean figures for each workload factor are computed.

The second data set is the adjusted workload factor data. These data are computed by the user using a combination of computerized simulation models and judgment.

Ideally, the mean of the workload factors would be taken from the total population. However, since these calculations are primarily manual, it is impractical to use the total population data unless the population is very small, i.e., fewer than ten. No recommendations as to the sample size are made since the degree of accuracy of this parameter estimate should be determined by the user. The user's decision must be based on the particular factors present at the time he begins collecting data, such as time and resources available for data collection and the degree of accuracy required. The user should be aware that the larger the sample size the more accurate the estimate will be.

Data will be input to the MIAM via an external file (see Appendix C).

Model Translation

Model translation is into the FORTRAN 77 language which is compatible with most Air Force computer systems. (Appendix D contains the coding and logic for the program.)

Validation

"Validation is the process of bringing to an acceptable level the user's confidence that any inference made about a system derived from a model is correct [52:29]." Validation of the model is critical and is, from the user's standpoint, the most important phase of the modeling process (52:29).

The output of a model almost always appears to be correct and is generally accepted as is without any in-depth scrutiny by the user. This is so because the investment of a large amount of time and effort by the user checking assumptions would in part negate the original purpose for developing a model. Hence, the user is relying heavily on the modeler to carefully and thoroughly validate the model and its assumptions. Otherwise, "erroneous results may be accepted with disastrous consequencies [52:29]."

Since the MIAM is an analytical model, the internal validation (verification) of the model's logic will be the only validation required and is accomplished as follows:

1. Select a SBSS to provide a representative data set. It makes no difference which base is chosen since the MIAM calculates manpower requirements the same way regardless of account size and mission.

2. Calculate the mean for each workload factor for this SBSS. (See Appendix A for an explanation of the procedure.)

3. Enter these mean data into the MIAM in both the actual workload factor data area and the predicted workload factor data area. Since the purpose is to determine if the MIAM is correctly calculating the required manpower authorizations and not the accuracy of the user's predictions, it is much more expedient to use the same input data for both areas.

4. Run the MIAM and obtain results.

5. Give the same data calculated in step 2 to the Air Force Supply Management Engineering Team (AFSMET) so that they may calculate the required manpower for these systems.

6. Compare the results obtained in step 6 to the results produced by the MIAM.

If the MIAM is correctly calculating the manpower authorizations, the figures should be equal. See Appendix G for results of the verification.

Sensitivity Analysis

The sensitivity analysis included in the MIAM measures how much manpower will change when a workload factor changes; i.e., for each unit increase of workload factor A, required manpower will increase by "X" amount.

This analysis assumes that the workload factors are independent of each other; i.e., workload factor A has no effect on workload factor B. This is recognized as a faulty assumption. In order to do a complete sensitivity analysis, the relationships between the workload factors must be determined; i.e., how much will the other workload factors

change if workload factor A is increased (or decreased). At the very least, it would be necessary to determine what relationships the model user (AFLMC) would be applying when predicting how the workload factors might change in response to some new policy or procedure. Research discovered that at the present time no objective means of measuring workload factor interaction exists. In fact, the AFLMC is not even considering those relationships, but are treating the workload factors as if they were independent. Hence, if that agency has not yet identified those relationships, it is reasonable to conclude there are no lower level agencies that have determined them either. Therefore, MIAM's sensitivity analysis in its present form is consistent with the predictive process that is going to be used by the AFLMC and any subsequent model user.

It should be noted that the AFLMC has recognized that the predictive process is incomplete and has initiated a research project to complete the process. This initiative is discussed in greater detail in Chapter IV.

While the predictive process and sensitivity analysis are valid in their present form, they are incomplete since they do not capture the total effect of changing a workload factor's value. The degree of dependence between the workload factors, that is, how strong are the indirect effects of changing a workload factor, is something the model user must certainly consider when making a decision based on the MIAM's output.

The following example illustrates the logic and procedure for calculating the sensitivity coefficient for each workload factor. Five definitions are necessary to understand the illustration.

Direct Relationship--The relationship between a specific workload factor and total manhours required in the unit directly affected. (The example looks at the workload factor, total document control cards (DCCs) produced, and its affect on the manning in the Document Control Unit.)

Indirect Relationship--The relationship between the manpower required in the sections affected directly by a specific workload factor and the section(s) whose manhour requirement is in some way determined by the manpower in the directly affected section. (The example examines the effect that changes in the manning of the Document Control Unit, caused by variation of the workload factor DCCs produced, have on manning in the Supply Systems Management Office.)

Functional Account Code (FAC)--A four to six digit alpha-numeric code used to identify each work center.

Manhour Availability Factor (MAF)--The total manhours an active duty Air Force member is expected to be available for duty in a one-month time period.

Workload Factor--Some measurable aspect of a work center's operation that manpower personnel have determined is linearly related to the total manhours required to accomplish the tasks associated with that section over a one-month period.

Example:

FAC 4163, Supply Document Control

Manhour Equation:

$$Y = 74.4 + .025X$$

where: Y = total manhours required

X = total document control cards (DCCs) produced.

FAC 4160, Supply Systems Management

Manhour Equation:

$$Y = 98.07 + 4.738X$$

where: Y = total manhours required

X = required manpower in subordinate work centers, FACs 4161, 4162, 4163, 4164.

Step 1. Take the partial derivative of the manhour equation for FAC 4163 with respect to X to determine how sensitive it is to changes in the workload factor DCCs produced.

$$\frac{\partial Y}{\partial X} = .025$$

This means that for every additional DCC produced, .025 additional manhours are required in the Supply Document Control Unit.

Step 2. Convert the figure obtained in step 1 to manpower required. To do this, divide the manhours figure by the appropriate manhour availability factor (MAF).

$$.025/145.2 = .0001722$$

This says that for every additional DCC produced, .00017 more persons are needed. Therefore, 5,882 additional DCCs would warrant one additional person in the Document Control Unit.

Step 3. Take the partial derivative of the manhour equation for FAC 4160 with respect to X to determine how sensitive it is to changes in the required manpower in its subordinate work centers

$$\frac{\partial Y}{\partial X} = 4.738$$

This says that every person added to one of its subordinate work centers adds 4.738 hours to its manhour requirement.

Step 4. Link total manhours required in FAC 4160 to total DCCs produced. To do this, multiply the figure obtained in step 3 by the figure obtained in step 2.

$$4.738 \times .00017 = .000805$$

This says that every additional DCC produced will add .000805 manhours to the manhour requirement in FAC 4160.

Step 5. Convert the figure obtained in step 4 to manpower required by following the same logic used in step 2.

$$.000805/145.2 = .0000055$$

This says that for every additional DCC produced, indirectly .0000055 more personnel will be needed in FAC 4160. Therefore, 181,818 more DCCs would have to be produced to warrant one additional person in FAC 4160. This illustrates the relative insensitivity of the manpower requirements in the FACs indirectly affected to changes in the workload factor data.

Step 6. Summarize figures to obtain total result. To do this, add the figures calculated in steps 2 and 5 to obtain a figure that represents the total effect that the workload factor, DCCs produced, has on manpower in a SBSS.

$$.0001722 + .0000055 = .0001777$$

This says that for every additional DCC produced, .0001777 additional persons are needed.

Notes and Conclusions: For the sake of simplicity, this example only illustrated one direct and one indirect relationship. For the majority of workload factors there will be multiples of each. The calculation will be identical except that instead of one direct and one indirect relationship to be added as in step 6, there may be several. Additionally, it should be noted that this sensitivity analysis

only calculates the effect of indirect relationships that are once removed from the direct relationships. Indeed, there are relationships that are up to four times removed. These were omitted because the effects were so small that they had no significant impact.

For several FACs (4100, 4120, 4121, 4123, 4141A, 4141B, and 4142) an exception to the procedures of steps 1 and 3 is made. Since the manhour equations for these FACs are higher order equations and the partial derivative of a higher order equation always contain the variable itself, it cannot be simply added to the derivative order of the straight-line equations to obtain the cumulative effect as illustrated.

A plot of these equations over the valid workload data range as specified in the respective manpower standards reveals that these lines have very little curve in them. Because these equations are nearly straight lines over the relevant range, for the sake of simplicity the slope of the straight line that most closely parallels the curved lines of these equations is estimated. This procedure provides a single value as in the straight-line equations.

This estimation is accomplished using the "S" statistics package on the VAX 11-170 computer system. Inputting the same data points used to plot the graphs of these lines and then using the "regress (X,Y)" command, the "S" program performs a least squares calculation and computes the Y intercept and slope, of the straight line that best fits the

data. Note that this program also calculates the value for the R-squared (coefficient of correlation). This figure serves to verify our observation that the lines for these FACs are nearly straight. The R-square values for all lines were adequate (.75 or higher) for our purposes.

Appendix E lists all the direct and indirect relationships for each workload factor along with calculated sensitivity coefficients. With these coefficients, the model user can conduct sensitivity analyses on any workload factor. The user could, for example, determine how much receipts would have to rise before manpower increases to a certain level; or how much receipts, issues, and shipments would have to rise (or fall) in combination before manpower increases or falls to a specified level; or simply, what are the most and least sensitive factors. The flexibility and capability this feature provides is a valuable tool. Appendix B, The Sample Output, illustrates how these sensitivity coefficients are applied within the MIAM.

Implementation

This effort was originally proposed and sponsored by the Directorate of Supply at the Air Staff, Washington DC. They, in turn, directed the AFLMC, Gunter AFS, Alabama, to develop a SBSS Manpower Impact Policy Assessment Model. The AFLMC, in turn, agreed to allow two students to develop the model as a masters thesis. Implementation, therefore, will be assured as long as the thesis meets all the objectives

listed in the AFLMC Project Plan, #830204-50 (see Appendix G). In fact, the MIAM has achieved or exceeded all stated objectives. Additionally, an interim progress report made directly to the Commander of the AFLMC on 16 March 1984 was very favorably received. Therefore, there is little doubt that the MIAM will be put into use at the AFLMC as soon as it is validated.

Implementation at the MAJCOM level and below will most likely be withheld until MIAM has had an opportunity to develop some operational history that can be documented.

IV. Concluding Remarks

Research Summary

This research effort proposes an analytic model which evaluates the impact of policy decisions on manpower requirements in a typical Standard Base Supply System (SBSS). This innovative and unique model is the first to integrate Air Force Manpower Standards and workload factors in order to provide objective data for decision-making.

The Manpower Impact Assessment Model (MIAM) gives the decision maker three advantages he has not previously enjoyed. First is the capability to predict manpower requirements objectively. This allows implementation of policy changes to coincide with manpower availability by eliminating the need for a lengthy manpower requirement assessment. Further, this objective prediction permits the decision maker to redistribute manpower if policy implementation cannot be delayed in order to coincide with manpower availability.

The MIAM's second advantage is the incorporation of a sensitivity analysis as a part of the model output. As one of a few models with this significant capability, the MIAM allows the decision maker to evaluate the sensitivity of the model output as a function of the degree of uncertainty in the input value. Hence, more emphasis can be placed on data collection processes involving the variables having a high degree of uncertainty if they significantly affect the model output.

Additionally, the MIAM provides virtually immediate feedback on changes in manpower requirements. This represents a drastic savings in time and manpower evaluation resources currently expended. Finally, it increases dramatically the decision maker's flexibility when considering various alternatives.

Recommended Improvements

Three aspects of the MIAM present concerns. First is the subjective nature of some of the data provided as input to the model by the user. The second is the lack of appropriate data collection techniques, and the third is the MIAM's inability to break down the aggregate manpower figures to determine ranks and skill levels.

One of the necessary assumptions is that the information provided by the user on the amount of change in a workload factor as a result of a policy decision is an accurate assessment. Investigation of this assumption reveals that subjective data, i.e., estimations based on experience and subjective evaluations of information, are major parts of the formulation of the input data for the MIAM.

Further investigation reveals that the broad statistical base of information required by the MIAM is not readily available. While the lack of skill level and rank information does not invalidate the MIAM's output, it is an inconvenience to the decision maker to have to go to the Air Force Manpower

Standards to gather this information. The following recommendations are presented in order to alleviate these concerns.

A significant improvement to the predictive process would be the discovery and inclusion in the model of the interrelationships between the workload factors. At the present time, these relationships are unknown. A full regression analysis of the workload factors could help determine these interrelationships.

Similarly, the driving workload factors should be identified through a sensitivity analysis on the workload factors that includes the interrelationships. In this way, model users would be able to pinpoint the total effect on manpower of each workload factor.

In order to remedy the lack of appropriate data collection techniques for the MIAM, the following recommendation is offered: Modify the data collection capability of the AFLMC so as to enable collection of workload factor data for all SBSSs using automated methods.

At present, only a portion of the data can be obtained in this manner, and even that requires a great deal of manual manipulation before it can be used to compute the mean of the workload factors. The mean of the workload factors used by the MIAM would be much more accurate if they could be calculated using all the available data; i.e., the whole population not just a sample. In order to do this, the AFLMC could request the Air Force Data Systems Design Center (AFDSDC) to

develop a program that will pull the required data off the tapes of M-32 data received from all base supply squadrons. These data could be put on a tape and filed in the AFLMC computer system. This would not only increase the accuracy of the mean workload data factors input into the MIAM but would also:

1. Increase the accuracy of the MIAM's calculation of presently authorized strength

2. Give the user (AFLMC) a more accurate set of baseline workload factor data on which to assess decision impact

3. Result in more accurate assessments of required authorizations if the specific policy/procedure in question is implemented

4. Decrease significantly the manhours required to make a prediction using the MIAM, since completing the automation of the data collection process would virtually eliminate the large amount of manual data manipulation presently required

5. Decrease the cost of manpower requirement evaluations currently done manually by local Air Force Management Engineering Teams

6. Increase the effective use of manpower resources in the SBSS by more rapidly assessing manpower requirements, hence permitting the elimination of overages and shortages

We recommend this data collection capability be developed as soon as possible and twelve months of data be collected as a minimum to insure statistical sufficiency.

These concerns and recommendations have been discussed with the AFLMC who share these beliefs and have indicated action will be taken in these areas.

Applications

The MIAM is designed to be used at the Air Force level of the supply arena. Even though this research deals with the Air Force level of activity, the MIAM can be adapted to function at the Major Command (MAJCOM) level by changing the Air Force aggregate multiplier to reflect the particular MAJCOM requirement. In other words, if the MAJCOM has only CONUS bases, the output from the MIAM can be multiplied by the number of bases in the command to arrive at an aggregate figure. If more than one category of Standard Base Supply System is in the command, the number of SBSSs in each category should be used as a multiplier of the MIAM output for that category.

Similarly, if the MIAM is used at base level, no multiplier is used since the MIAM output will be predicated on input for that base only. Further, the MIAM can be used at the branch or even section level by inserting zero values for all nonapplicable data requirements.

Further Research

Further research is recommended in the area of the impact of policy or procedural decisions on manpower requirements in all Air Force Specialty Codes (AFSC). Following the

principles and techniques used in this research, models could be developed to manipulate data from some data source similar to the M-32 document used in this work. If no such document currently exists for a particular AFSC, one could be developed and the Air Force manpower standards could be applied for a particular AFSC. This basic technique could be applied to all AFSCs and the outputs summed to arrive at an Air Force level assessment of a decision's impact on manpower requirements.

As touched upon earlier, other areas of manpower impact research include the subjective nature of some inputs to the model and the necessity to develop a data storage technique to establish a statistically broad data base. Both these areas are fertile fields for further applied research.

Appendix A: Sample Illustration of a Manpower Standard Application

Definitions:

Manhour Availability Factor (MAF)--The total manhours an active duty Air Force member is expected to be available for duty in a one-month time period. This figure is different for CONUS and overseas accounts.

Workload Factor--Some measurable aspect of a work center's operation that manpower personnel have determined is linearly related to the total manhours required to accomplish the tasks associated with that section over a one-month period.

Manhour Equation--The equation developed by Air Force manpower personnel that relates the workload factor(s) to manhours required to perform the tasks of a specific section.

Functional Account Code (FAC)--A four to six digit alpha-numeric code used to identify each work center.

Step 1--Review the Air Force Manpower Standard (AFMS) that is applicable to the section whose manpower requirements we wish to predict. For our example, we will use AFMS 4122, Supply Materiel Receiving.

Step 2--Identify the workload factor that must be measured and obtain the data for a period not to exceed one year prior to the date the measurement is taken. Paragraph 4 of any AFMS will provide this information and also indicate where it can be found.

Example: For Supply Materiel Receiving (FAC 4122), AFMS 4122, the applicable workload factor is total receipts. If the measurement were taken in April 1984, we would go to the appropriate source and obtain the following data:

Month/Year	Total Receipts
Mar 84	6,600
Feb 84	6,200
Jan 84	6,400
Dec 83	7,000
Nov 83	6,900
Oct 83	6,200
Sep 83	6,100
Aug 83	6,700
Jul 83	6,100
Jun 83	6,400
May 83	7,000
Apr 83	7,100
Total	78,700

Step 3--Divide the total figure obtained in step 2 by 12 to obtain a monthly average.

$$78{,}700/12 = 6{,}558$$

Step 4--Go to the AFMS (Supply Materiel Receiving, AFMS 4122) to get the appropriate manhour equation. All AFMSs used in this research are cited in the bibliography in

numerical order. Note that sometimes there are different equations for CONUS and overseas accounts. For example, the CONUS equation is:

$$Y = 574.71 + .2143X$$

where

$$Y = \text{total manhours required}$$
$$X = \text{average monthly receipts}$$

Using the figure we obtained in step 3, the result is

$$\begin{aligned} Y &= 574.71 + .2143\ (6{,}558) \\ &= 574.71 + 1405.45 \\ &= 1980.16 \end{aligned}$$

Step 5--Divide this figure by the appropriate MAF (143.5 for overseas accounts and 145.2 for CONUS accounts) to obtain the total manpower required. Since our example was of a CONUS account, we will use 145.2.

$$1980.16/145.2 = 13.63$$

This figure will then be rounded and the total manpower required for this particular unit will be 14.

Note that the MAF factors used by the MIAM only apply to those bases who operate on a normal workweek.

Appendix B: Sample MIAM Output

CONUS Accounts

Average SBSS Manpower Figures

Work Center	Present Requirement	Projected Requirement	Percent Change
FAC 4100, Chief of Supply	3.	4.	9.5
FAC 4120, Storage and Distribution	2.	2.	8.9
FAC 4121, Inspection Unit	8.	10.	30.3
FAC 4122, Receiving Unit	13.	18.	33.8
FAC 4123, Pickup and Delivery Unit	19.	21.	14.0
FAC 4124, Storage and Issue Unit	21.	26.	27.7
FAC 412X, S&D Branch Totals	63.	78.	24.6
FAC 4130, Management and Procedures	2.	2.	4.8
FAC 4131, Management Analysis Unit	2.	2.	9.5
FAC 4132, Supply Training Unit	1.	2.	42.9
FAC 4133, Procedures and Standardization Unit	4.	4.	4.8
FAC 4134, Funds Management Unit	3.	3.	14.5
FAC 413X, M&P Branch Totals	12.	14.	12.0
FAC 4140, Material Management	2.	2.	5.8
FAC 4141A, Stock Control Section	1.	1.	3.8
FAC 4141B, Requirements Unit	5.	7.	29.1
FAC 4141C, Requisitioning Unit	8.	8.	6.3
FAC 4142, MICAP Management Unit	8.	10.	25.5
FAC 414X, MM Branch Totals	24.	28.	17.3

Work Center	Present Requirement	Projected Requirement	Percent Change
FAC 4150, Customer Support	2.	3.	4.9
FAC 4151, Customer Liaison Unit	1.	3.	78.3
FAC 4152, Material Support Section	1.	1.	14.1
FAC 4152A, Demand Processing Unit	14.	17.	24.2
FAC 4152B, Bench Stock Support Unit	6.	6.	5.2
FAC 4153, Retail Sales Section	1.	1.	.0
FAC 4153A, Base Service Store	4.	4.	5.9
FAC 4153B, Individual Equipment Unit	7.	7.	8.4
FAC 4154, Allowance and Authorization Unit	9.	11.	34.3
FAC 415X, CS Branch Totals	45.	53.	19.6
FAC 4160, Systems Management	1.	1.	8.5
FAC 4161A, ADPM/PCAM Operations Office	1.	1.	6.6
FAC 4161C, PCAM/Distribution Unit	4.	6.	26.3
FAC 4162, Records Maintenance Unit	4.	4.	2.8
FAC 4163, Document Control Unit	1.	2.	37.6
FAC 4164, Inventory Unit	3.	4.	37.2
FAC 416X, SM Branch Totals	15.	18.	20.0
FAC 41XX, Squadron Totals	162.	195.	20.5
FAC 41XX, System Totals	324.	390.	20.5
Number of Bases in System	2.		

NOTE: Due to the decimal rounding process, some work centers will show a percentage change but no integer change.

Sensitivity Analysis

Workload Factor	Total Projected Requirement if Factor is Over-estimated 25%	Total Projected Requirement if Factor is Esti-mated Correctly	Total Projected Requirement if Factor is Under-estimated 25%
Receipts	377.	390.	403.
Turn-Ins	382.	390.	398.
Issues	379.	390.	401.
Shipments	38[illegible]	390.	391.
Item Records	387.	390.	393.
Reparables	389.	390.	392.
DORs	382.	390.	393.
OCCRs	388.	390.	392.
Transactions	376.	390.	405.
BS Issues, DORs, DOUs	388.	390.	392.
BSS/TIC Issues	388.	390.	392.
IEU Issues	388.	390.	393.
AFF 601s Processed	386.	390.	394.
Requisitions (-LP)	388.	390.	393.
LP Requisitions	390.	390.	391.
MICAP Starts	387.	390.	394.
DCCs	389.	390.	391.
Units Inventoried	389.	390.	392.

Overseas Accounts

Average SBSS Manpower Figures

Work Center	Present Requirement	Projected Requirement	Percent Change
FAC 4100, Crief of Supply	3.	4.	11.6
FAC 4120, Storage and Distribution	2.	3.	11.9
FAC 4121, Inspection Unit	8.	10.	23.3
FAC 4122, Receiving Unit	18.	25.	29.0
FAC 4123, Pickup and Delivery Unit	19.	22.	12.3
FAC 4124, Storage and Issue Unit	24.	38.	38.3
FAC 412X, S&D Branch Totals	70.	98.	38.6
FAC 4130, Management and Procedures	2.	2.	5.1
FAC 4131, Management Analysis Unit	2.	2.	10.1
FAC 4132, Supply Training Unit	1.	2.	44.4
FAC 4133, Procedures and Standardization Unit	4.	4.	5.6
FAC 4134, Funds Management Unit	3.	3.	14.5
FAC 413X, M&P Branch Totals	12.	14.	12.7
FAC 4140, Material Management	2.	2.	2.9
FAC 4141A, Stock Control Section	1.	1.	.1
FAC 4141B, Requirements Unit	5.	5.	-8.7
FAC 4141C, Requisitioning Unit	8.	8.	6.3
FAC 4142, MICAP Management Unit	8.	10.	25.5
FAC 414X, MM Branch Totals	24.	26.	8.7
FAC 4150, Customer Support	2.	3.	5.0
FAC 4151, Customer Liaison Unit	2.	3.	78.3
FAC 4152, Material Support Section	1.	1.	14.2
FAC 4152A, Demand Processing Unit	14.	17.	24.2
FAC 4152B, Bench Stock Support Unit	6.	6.	5.2

Work Center	Present Requirement	Projected Requirement	Percent Change
FAC 4153, Retail Sales Section	1.	1.	.0
FAC 4153A, Base Service Store	4.	4.	5.9
FAC 4153B, Individual Equipment Unit	7.	7.	8.4
FAC 4154, Allowance and Authorization Unit	9.	12.	34.3
FAC 415X, CS Branch Totals	45.	54.	19.6
FAC 4160, Systems Management	1.	1.	9.5
FAC 4161A, ADPM/PCAM Operations Office	1.	1.	6.7
FAC 4161C, PCAM/Distribution Unit	4.	6.	26.3
FAC 4162, Records Maintenance Unit	4.	4.	2.8
FAC 4163, Document Control Unit	1.	2.	37.6
FAC 4164, Inventory Unit	3.	4.	37.2
FAC 416X, SM Branch Totals	15.	19.	20.0
FAC 41XX, Squadron Totals	171.	214.	25.3
FAC 41XX, System Totals	342.	429.	25.3
Number of Bases in System	2.		

NOTE: Due to the decimal rounding process, some work centers will show a percentage change but no integer change.

Sensitivity Analysis

Workload Factor	Total Projected Requirement if Factor is Over-estimated 25%	Total Projected Requirement if Factor is Esti-mated Correctly	Total Projected Requirement if. Factor is Under-estimated 25%
Receipts	392.	429.	465.
Turn-Ins	409.	429.	449.
Issues	417.	429.	440.
Shipments	427.	429.	430.
Item Records	426.	429.	431.
Reparables		429.	
DORs	426.	429.	431.
OCCRs	427.	429.	430.
Transactions	414.	429.	443.
BS Issues, DORs, DOUs	426.	429.	431.
BSS/TIC Issues	427.	429.	430.
IEU Issues	426.	429.	431.
AFF 601s Processed	424.	429.	433.
Requisitions (-LP)	426.	429.	431.
LP Requisitions	428.	429.	429.
MICAP Starts	425.	429.	432.
DCCs	428.	429.	429.
Units Inventoried	427.	429.	430.

Appendix C: Preparation of Data File

Inputs are made to MIAM via an external file appropriately named "input." Before the MIAM can be run, this file must be created with the data to be input loaded according to the following format:

Line 1	-	Number of bases CONUS/overseas						
Line 2	-	Total	Receipts	CONUS-baseline/predicted,overseas-/predicted baseline				
Line 3	-	"	Turn-Ins	"	"	"	"	"
Line 4	-	"	Issues	"	"	"	"	"
Line 5	-	"	Shipments	"	"	"	"	"
Line 6	-	"	Item Records	"	"	"	"	"
Line 7	-	"	Reparables	"	"	"	"	"
Line 8	-	"	DORs	"	"	"	"	"
Line 9	-	"	OCCRs	"	"	"	"	"
Line 10	-	"	Transactions	"	"	"	"	"
Line 11	-	"	BS Issues, DORs, DOUs	"	"	"	"	"
Line 12	-	"	BSS/TIC Issues	"	"	"	"	"
Line 13	-	"	IEU Issues	"	"	"	"	"
Line 14	-	"	AFF 601s Processed	"	"	"	"	"
Line 15	-	"	Requisitions (-LP)	"	"	"	"	"
Line 16	-	"	LP Requisitions	"	"	"	"	"
Line 17	-	"	MICAP Starts	"	"	"	"	"
Line 18	-	"	DCCs	"	"	"	"	"
Line 19		"	Units Inventoried	"	"	"	"	"

The MIAM reads the data in a "free field" format; therefore, spaces, not commas, should be inserted between figures. Also, if there is no CONUS data to be loaded, a "Ø" should be inserted in the spaces where that data would normally be placed.

```
2 2
6200 9200 6200 9200
2900 5900 2900 5900
13000 16000 13000 16000
1500 1800 1500 1800
73000 76000 73000 76000
2600 2900 2600 2900
3200 3500 3200 3500
300 600 300 600
103000 133000 103000 133000
3600 3900 3600 3900
4000 4300 4000 4300
2500 2800 2500 2800
500 800 500 800
7100 7400 7100 7400
700 1000 700 1000
700 1000 700 1000
5000 8000 5000 8000
50000 80000 50000 80000
```

Figure 5. Sample Input File

Appendix D: Fortran Code

```
*****************************************************************************
*                                                                           *
*                 MANPOWER IMPACT ASSESSMENT MODEL (MIAM)                  *
*                                                                           *
*****************************************************************************
*                                                                           *
* STUDENT NAMES: Robert Burleson                                            *
*                Larry Abney                                                *
* COURSE: Thesis                                                            *
* ADVISOR : Lt Col Smith              PROGRAM NAME: miam.f                  *
*                                                                           *
* DESIGN DATE: Nov 83                 LAST UPDATE: Apr 84                   *
*                                                                           *
*---------------------------------------------------------------------------*
* DESCRIPTION: MIAM is an analytical model that computes manpower require-  *
* ments for standard base supply systems (SBSSs).                           *
*                                                                           *
*                                                                           *
*---------------------------------------------------------------------------*
* INTERNAL VARIABLES: Due to the very basic structure of this program there *
* are an extremely large number of variables. So many that it became imposs-*
* ible to assign each a meaningful name. Therefore the following system for *
* identifying variables was developed.                                      *
*                                                                           *
* With few exceptions (to be noted later) all variables have the same basic *
* structure which is as follows.                                            *
*                                                                           *
*           Position 1 : An alpha character designating the variable type.  *
*                                                                           *
*                        X = workload factor                                *
*                        Y = manhours required                              *
*                        W = manpower required (by FAC)                     *
*                        Z = manpower required (by branch)                  *
*                                                                           *
*           Positions 2-3 : Numeric characters that identify more specific- *
*                        ally the variable.                                 *
*                                                                           *
*                        For type X variables this field identifies a       *
*                        specific workload factor according to the foll-    *
*                        owing chart.                                       *
*                                                                           *
*                             01 = Receipts                                 *
*                             02 = Turn-ins                                 *
*                             03 = Issues                                   *
*                             04 = Shipments                                *
*                             05 = Item Records                             *
*                             06 = Reparables                               *
*                             07 = DORs                                     *
*                             08 = OCCRs                                    *
*                             09 = Transactions                             *
*                             10 = Bench Stoch Issues, DORs, DOUs           *
*                             11 = L/Is Issued by the BSS and TIC           *
*                             12 = L/Is Issued by the IEU                   *
*                             13 = Line Entries Per Month on the            *
```

AFF 600
14 = Requisitions (except for LP)
15 = LP Requisitions
16 = MICAP Starts
17 = DCCs
18 = Units Inventoried

For W and Y type variables this field identifies a specific Functional Account Code (FAC) according to the following chart.

01 = FAC 4120
02 = " 4121
03 = " 4122
04 = " 4123
05 = " 4124
10 = " 4130
11 = " 4131
12 = " 4132
13 = " 4133
14 = " 4134
20 = " 4100
30 = " 4150
31 = " 4151
32 = " 4152
33 = " 4152A
34 = " 4152B
35 = " 4153
36 = " 4153A
37 = " 4153B
38 = " 4154

For Z type variables this field identifies a specific branch according to the following chart.

01 = LGSD
02 = LGSC
03 = LGSM
04 = LGSS
05 = LGSP

Position 4 : A numeric character that specifies whether the value pertains to a CONUS SBSS or an overseas SBSS.

1 = Conus
2 = Overseas

Position 5 : An alpha character that specifies the variables specific content.

```
*                                                                        *
*                    A = Value using baseline (average)                  *
*                        workload factor values.                         *
*                                                                        *
*                    B = Value using the predicted work-                 *
*                        load factor values.                             *
*                                                                        *
*                    C = Percent change in the value of                  *
*                        A and B, i.e., ((B-A)/A)100.                    *
*                                                                        *
*                                                                        *
*                                                                        *
* Other variables:                                                       *
*                                                                        *
*                         Total Manpower Variable                        *
*                                                                        *
* This variable represents the total manpower authorized in the SBSS.    *
*                                                                        *
*          Position 1 : The first character indicates whether            *
*                       the value is for a single                        *
*                       (average) SBSS or all the SBSSs' in the          *
*                       system being modelled.                           *
*                                                                        *
*                           t = Single (average) SBSS value              *
*                                                                        *
*                           g = Total value for system                   *
*                                                                        *
*         Position 2 : A numeric character that specifies whether the val-*
*                      ue pertains to a CONUS SBSS or an overseas SBSS.  *
*                                                                        *
*                                  1 = Conus                             *
*                                  2 = Overseas                          *
*                                                                        *
*         Position 3 : An alpha character that specifies the variables   *
*                      specific content.                                 *
*                                                                        *
*                         A = Value using baseline (average)             *
*                             workload factor values.                    *
*                                                                        *
*                         B = Value using the predicted work-            *
*                             load factor values.                        *
*                                                                        *
*                                                                        *
*                                                                        *
*                                                                        *
*                        Aggregate Multiplier                            *
*                                                                        *
* This variable contains the number of bases included in the system being *
* modelled by MIAM. It is used to multiply the total values for the average *
* SBSS in order to obtain the total values (in manpower) for the system. *
* There are only two values for this variable.                           *
*                                                                        *
*                   n1 = number of CONUS bases                           *
*                   n2 = number of overseas bases                        *
```

```
*                                                                            *
* Note: A minimum value of one must be assigned to this variable.           *
*                                                                            *
*                                                                            *
*                                                                            *
*                          Sensitivity Variables                             *
*                                                                            *
* These variables contain the computed values for total manpower required   *
* for the system if errors are made in the estimated workload factor stat-  *
* istics.                                                                    *
*                                                                            *
*          Position 1 = "g"                                                  *
*                                                                            *
*          Positions 2-3 = Two integers identifying the workload factor     *
*                          whose sensitivity is being measured.             *
*                                                                            *
*                             see above                                      *
*                                                                            *
*          Position 4 = A single integer identifying if the value applies   *
*                       to the CONUS or overseas SBSS requirement.          *
*                                                                            *
*                             1 = CONUS                                      *
*                             2 = overseas                                   *
*                                                                            *
*          Position 5 = A single alphabetical character identifying if      *
*                       the value applys to an overestimation or under-     *
*                       estimation of the workload factor statistic.        *
*                                                                            *
*                            o = overestimation                              *
*                            u = underestimation                             *
*                                                                            *
*                                                                            *
*----------------------------------------------------------------------------*
* FILES USED: "input" and "output" which contain the input data and output  *
* data respectively.                                                         *
*                                                                            *
*                                                                            *
*----------------------------------------------------------------------------*
* MODULES CALLED: There are eleven modules in addition to the main program. *
* They are lgsdc, lgsdo, lgscc, lgsco, lgsmc, lgsmo, lgssc, lgsso, lgspc,   *
* lgspo, and sentvy.                                                         *
*                                                                            *
******************************************************************************
c
c Declare variables.
c
      real w011a,w021a,w031a,w041a,w051a,
     +     w011b,w021b,w031b,w041b,w051b,
     +     x011a,x021a,x031a,x041a,x051a,x061a,x071a,
     +     x011b,x021b,x031b,x041b,x051b,x061b,x071b,
     +     y011a,y021a,y031a,y041a,y051a,
     +     y011b,y021b,y031b,y041b,y051b,
     +     z011a,
     +     z011b
```

```
      real w012a,w022a,w032a,w042a,w052a,
     +     w012b,w022b,w032b,w042b,w052b,
     +     x012a,x022a,x032a,x042a,x052a,x062a,x072a,
     +     x012b,x022b,x032b,x042b,x052b,x062b,x072b,
     +     y012a,y022a,y032a,y042a,y052a,
     +     y012b,y022b,y032b,y042b,y052b,
     +     z012a,
     +     z012b
      real w301a,w311a,w321a,w331a,w341a,w351a,w361a,w371a,w381a,
     +     w301b,w311b,w321b,w331b,w341b,w351b,w361b,w371b,w381b,
     +     x081a,x091a,x101a,x111a,x121a,x131a,
     +     x081b,x091b,x101b,x111b,x121b,x131b,
     +     y301a,y311a,y321a,y331a,y341a,y351a,y361a,y371a,y381a,
     +     y301b,y311b,y321b,y331b,y341b,y351b,y361b,y371b,y381b,
     +     z021a,
     +     z021b
      real w302a,w312a,w322a,w332a,w342a,w352a,w362a,w372a,w382a,
     +     w302b,w312b,w322b,w332b,w342b,w352b,w362b,w372b,w382b,
     +     x082a,x092a,x102a,x112a,x122a,x132a,
     +     x082b,x092b,x102b,x112b,x122b,x132b,
     +     y302a,y312a,y322a,y332a,y342a,y352a,y362a,y372a,y382a,
     +     y302b,y312b,y322b,y332b,y342b,y352b,y362b,y372b,y382b,
     +     z022a,
     +     z022b
      real w401a,w411a,w421a,w431a,w441a,
     +     w401b,w411b,w421b,w431b,w441b,
     +     x091a,x141a,x151a,x161a,
     +     x091b,x141b,x151b,x161b,
     +     y401a,y411a,y421a,y431a,y441a,
     +     y401b,y411b,y421b,y431b,y441b,
     +     z031a,
     +     z031b
      real w402a,w412a,w422a,w432a,w442a,
     +     w402b,w412b,w422b,w432b,w442b,
     +     x092a,x142a,x152a,x162a,
     +     x092b,x142b,x152b,x162b,
     +     y402a,y412a,y422a,y432a,y442a,
     +     y402b,y412b,y422b,y432b,y442b,
     +     z032a,
     +     z032b
      real w501a,w511a,w521a,w531a,w541a,w551a,w561a,
     +     w501b,w511b,w521b,w531b,w541b,w551b,w561b,
     +     x051a,x091a,x171a,x181a,
     +     x051b,x091b,x171b,x181b,
     +     y501a,y511a,y521a,y531a,y541a,y551a,y561a,
     +     y501b,y511b,y521b,y531b,y541b,y551b,y561b,
     +     z041a,
     +     z041b
      real w502a,w512a,w522a,w532a,w542a,w552a,w562a,
     +     w502b,w512b,w522b,w532b,w542b,w552b,w562b,
     +     x052a,x092a,x172a,x182a,
     +     x052b,x092b,x172b,x182b,
     +     y502a,y512a,y522a,y532a,y542a,y552a,y562a,
     +     y502b,y512b,y522b,y532b,y542b,y552b,y562b,
```

```
+     z042a,
+     z042b
 real w101a,w111a,w121a,w131a,w141a,
+     w101b,w111b,w121b,w131b,w141b,
+     x051a,x081a,x091a,
+     x051b,x081b,x091b,
+     y101a,y111a,y121a,y131a,y141a,
+     y101b,y111b,y121b,y131b,y141b,
+     z051a,
+     z051b
 real w102a,w112a,w122a,w132a,w142a,
+     w102b,w112b,w122b,w132b,w142b,
+     x052a,x082a,x092a,
+     x052b,x082b,x092b,
+     y102a,y112a,y122a,y132a,y142a,
+     y102b,y112b,y122b,y132b,y142b,
+     z052a,
+     z052b
 real w201a,
+     w201b,
+     y201a,
+     y201b
 real w202a,
+     w202b,
+     y202a,
+     y202b
 real n1,n2
 real t1a,t1b,t2a,t2b
 real g1a,g1b,g2a,g2b
 real w011c,w021c,w031c,w041c,w051c,
+     w012c,w022c,w032c,w042c,w052c,
+     w101c,w111c,w121c,w131c,w141c,
+     w102c,w112c,w122c,w132c,w142c,
+     w201c,
+     w202c,
+     w301c,w311c,w321c,w331c,w341c,w351c,w361c,
+     w371c,w381c,
+     w302c,w312c,w322c,w332c,w342c,w352c,w362c,
+     w372c,w382c,
+     w401c,w411c,w421c,w431c,w441c,
+     w402c,w412c,w422c,w432c,w442c,
+     w501c,w511c,w521c,w531c,w541c,w551c,w561c,
+     w502c,w512c,w522c,w532c,w542c,w552c,w562c,
+     z011c,z021c,z031c,z041c,z051c,
+     z012c,z022c,z032c,z042c,z052c,
+     t1c,g1c,
+     t2c,g2c
 real g011o,g021o,g031o,g041o,g051o,g061o,
+     g071o,g081o,g091o,g101o,g111o,g121o,
+     g131o,g141o,g151o,g161o,g171o,g181o,
+     g011u,g021u,g031u,g041u,g051u,g061u,
+     g071u,g081u,g091u,g101u,g111u,g121u,
+     g131u,g141u,g151u,g161u,g171u,g181u,
+     g012o,g022o,g032o,g042o,g052o,g062o,
```

```
     +     g072o,g082o,g092o,g102o,g112o,g122o,
     +     g132o,g142o,g152o,g162o,g172o,g182o,
     +     g012u,g022u,g032u,g042u,g052u,g062u,
     +     g072u,g082u,g092u,g102u,g112u,g122u,
     +     g132u,g142u,g152u,g162u,g172u,g182u
c
c Link program to external files.
c
      open(unit=10,file='input')
      open(unit=11,file='output')
c
c Rewind external files.
c
      rewind 10
      rewind 11
c
c Read input data from external file "input".
c
      read(unit=10,fmt=*)n1,n2
      read(unit=10,fmt=*)x011a,x011b,x012a,x012b
      read(unit=10,fmt=*)x021a,x021b,x022a,x022b
      read(unit=10,fmt=*)x031a,x031b,x032a,x032b
      read(unit=10,fmt=*)x041a,x041b,x042a,x042b
      read(unit=10,fmt=*)x051a,x051b,x052a,x052b
      read(unit=10,fmt=*)x061a,x061b,x062a,x062b
      read(unit=10,fmt=*)x071a,x071b,x072a,x072b
      read(unit=10,fmt=*)x081a,x081b,x082a,x082b
      read(unit=10,fmt=*)x091a,x091b,x092a,x092b
      read(unit=10,fmt=*)x101a,x101b,x102a,x102b
      read(unit=10,fmt=*)x111a,x111b,x112a,x112b
      read(unit=10,fmt=*)x121a,x121b,x122a,x122b
      read(unit=10,fmt=*)x131a,x131b,x132a,x132b
      read(unit=10,fmt=*)x141a,x141b,x142a,x142b
      read(unit=10,fmt=*)x151a,x151b,x152a,x152b
      read(unit=10,fmt=*)x161a,x161b,x162a,x162b
      read(unit=10,fmt=*)x171a,x171b,x172a,x172b
      read(unit=10,fmt=*)x181a,x181b,x182a,x182b
c
c Call subroutine lgsdc.
c
      call lgsdc(w011a,w021a,w031a,w041a,w051a,z011a,
     +           w011b,w021b,w031b,w041b,w051b,z011b,
     +           w011c,w021c,w031c,w041c,w051c,z011c,
     +           x011a,x021a,x031a,x041a,x051a,x061a,x071a,
     +           x011b,x021b,x031b,x041b,x051b,x061b,x071b,
     +           y011a,y021a,y031a,y041a,y051a,
     +           y011b,y021b,y031b,y041b,y051b)
c
c Call subroutine lgsdo.
c
      call lgsdo(w012a,w022a,w032a,w042a,w052a,z012a,
     +           w012b,w022b,w032b,w042b,w052b,z012b,
     +           w012c,w022c,w032c,w042c,w052c,z012c,
     +           x012a,x022a,x032a,x042a,x052a,x062a,x072a,
```

```
     +            x012b,x022b,x032b,x042b,x052b,x062b,x072b,
     +            y012a,y022a,y032a,y042a,y052a,
     +            y012b,y022b,y032b,y042b,y052b)
c
c Call subroutine lgscc.
c
      call lgscc(w301a,w311a,w321a,w331a,w341a,w351a,w361a,w371a,
     +            w301b,w311b,w321b,w331b,w341b,w351b,w361b,w371b,
     +            w301c,w311c,w321c,w331c,w341c,w351c,w361c,w371c,
     +            w381a,
     +            w381b,
     +            w381c,
     +            x081a,x091a,x101a,x111a,x121a,x131a,
     +            x081b,x091b,x101b,x111b,x121b,x131b,
     +            y301a,y311a,y321a,y331a,y341a,y351a,y361a,y371a,
     +            y301b,y311b,y321b,y331b,y341b,y351b,y361b,y371b,
     +            y381a,
     +            y381b,
     +            z021a,
     +            z021b,
     +            z021c)
c
c Call subroutine lgsco.
c
      call lgsco(w302a,w312a,w322a,w332a,w342a,w352a,w362a,w372a,
     +            w302b,w312b,w322b,w332b,w342b,w352b,w362b,w372b,
     +            w302c,w312c,w322c,w332c,w342c,w352c,w362c,w372c,
     +            w382a,
     +            w382b,
     +            w382c,
     +            x082a,x092a,x102a,x112a,x122a,x132a,
     +            x082b,x092b,x102b,x112b,x122b,x132b,
     +            y302a,y312a,y322a,y332a,y342a,y352a,y362a,y372a,
     +            y302b,y312b,y322b,y332b,y342b,y352b,y362b,y372b,
     +            y382a,
     +            y382b,
     +            z022a,
     +            z022b,
     +            z022c)
c
c Call subroutine lgsmc.
c
      call lgsmc (w401a,w411a,w421a,w431a,w441a,
     +            w401b,w411b,w421b,w431b,w441b,
     +            w401c,w411c,w421c,w431c,w441c,
     +            x091a,x141a,x151a,x161a,
     +            x091b,x141b,x151b,x161b,
     +            y401a,y411a,y421a,y431a,y441a,
     +            y401b,y411b,y421b,y431b,y441b,
     +            z031a,
     +            z031b,
     +            z031c)
c
c Call subroutine lgsmo.
```

```
c
      call lgsmo (w402a,w412a,w422a,w432a,w442a,
     +            w402b,w412b,w422b,w432b,w442b,
     +            w402c,w412c,w422c,w432c,w442c,
     +            x092a,x142a,x152a,x162a,
     +            x092b,x142b,x152b,x162b,
     +            y402a,y412a,y422a,y432a,y442a,
     +            y402b,y412b,y422b,y432b,y442b,
     +            z032a,
     +            z032b,
     +            z032c)
c
c Call subroutine lgssc.
c
      call lgssc (w501a,w511a,w521a,w531a,w541a,w551a,w561a,
     +            w501b,w511b,w521b,w531b,w541b,w551b,w561b,
     +            w501c,w511c,w521c,w531c,w541c,w551c,w561c,
     +            x051a,x091a,x171a,x181a,
     +            x051b,x091b,x171b,x181b,
     +            y501a,y511a,y521a,y531a,y541a,y551a,y561a,
     +            y501b,y511b,y521b,y531b,y541b,y551b,y561b,
     +            z041a,
     +            z041b,
     +            z041c)
c
c Call subroutine lgsso.
c
      call lgsso (w502a,w512a,w522a,w532a,w542a,w552a,w562a,
     +            w502b,w512b,w522b,w532b,w542b,w552b,w562b,
     +            w502c,w512c,w522c,w532c,w542c,w552c,w562c,
     +            x052a,x092a,x172a,x182a,
     +            x052b,x092b,x172b,x182b,
     +            y502a,y512a,y522a,y532a,y542a,y552a,y562a,
     +            y502b,y512b,y522b,y532b,y542b,y552b,y562b,
     +            z042a,
     +            z042b,
     +            z042c)
c
c Call subroutine lgspc.
c
      call lgspc (w101a,w111a,w121a,w131a,w141a,
     +            w101b,w111b,w121b,w131b,w141b,
     +            w101c,w111c,w121c,w131c,w141c,
     +            x051a,x081a,x091a,
     +            x051b,x081b,x091b,
     +            y101a,y111a,y121a,y131a,y141a,
     +            y101b,y111b,y121b,y131b,y141b,
     +            z011a,z021a,z031a,z041a,z051a,
     +            z011b,z021b,z031b,z041b,z051b,
     +            z051c)
c
c Call subroutine lgspo.
c
```

```
      call lgspo (w102a,w112a,w122a,w132a,w142a,
     +            w102b,w112b,w122b,w132b,w142b,
     +            w102c,w112c,w122c,w132c,w142c,
     +            x052a,x082a,x092a,
     +            x052b,x082b,x092b,
     +            y102a,y112a,y122a,y132a,y142a,
     +            y102b,y112b,y122b,y132b,y142b,
     +            z012a,z022a,z032a,z042a,z052a,
     +            z012b,z022b,z032b,z042b,z052b,
     +            z052c)
c
c Compute manhours required for FAC 4100, average CONUS account.
c
      y201a=42.03*(z011a+z021a+z031a+z041a+z051a)**.4831
      y201b=42.03*(z011b+z021b+z031b+z041b+z051b)**.4831
c
c Compute manpower required for FAC 4100, average CONUS account.
c
      w201a=y201a/145.2
      w201b=y201b/145.2
c
c Compute the percentage change in manpower for FAC 4100, average CONUS account.
c
      w201c=((w201b-w201a)/w201a)*100
c
c Compute manhours required for FAC 4100, average overseas account.
c
      y202a=42.03*(z012a+z022a+z032a+z042a+z052a)**.4831
      y202b=42.03*(z012b+z022b+z032b+z042b+z052b)**.4831
c
c Compute manpower required for FAC 4100, average overseas account.
c
      w202a=y202a/143.5
      w202b=y202b/143.5
c
c Compute the percentage change in manpower for FAC 4100, average overseas
c account.
c
      w202c=((w202b-w202a)/w202a)*100
c
c Compute the total manpower required for the average CONUS SBSS.
c
      t1a=z011a+z021a+z031a+z041a+z051a+w201a
      t1b=z011b+z021b+z031b+z041b+z051b+w201b
c
c Compute the total manpower required for the average overseas SBSS.
c
      t2a=z012a+z022a+z032a+z042a+z052a+w202a
      t2b=z012b+z022b+z032b+z042b+z052b+w202b
c
c Compute the total manpower required for all CONUS SBSSs included in the
c model.
c
      g1a=t1a*n1
```

```
      g1b=t1b*n1
c
c Compute the total manpower required for all overseas SBSSs included in
c the model.
c
      g2a=t2a*n2
      g2b=t2b*n2
c
c Call subroutine sentvy.
c
      call sentvy (x011b,x021b,x031b,x041b,x051b,x061b,x071b,x081b,
     +             x091b,x101b,x111b,x121b,x131b,x141b,x151b,x161b,
     +             x171b,x181b,
     +             x012b,x022b,x032b,x042b,x052b,x072b,x082b,
     +             x092b,x102b,x112b,x122b,x132b,x142b,x152b,x162b,
     +             x172b,x182b,
     +             g1b,g2b,
     +             g011o,g021o,g031o,g041o,g051o,g061o,
     +             g071o,g081o,g091o,g101o,g111o,g121o,
     +             g131o,g141o,g151o,g161o,g171o,g181o,
     +             g011u,g021u,g031u,g041u,g051u,g061u,
     +             g071u,g081u,g091u,g101u,g111u,g121u,
     +             g131u,g141u,g151u,g161u,g171u,g181u,
     +             g012o,g022o,g032o,g042o,g052o,g062o,
     +             g072o,g082o,g092o,g102o,g112o,g122o,
     +             g132o,g142o,g152o,g162o,g172o,g182o,
     +             g012u,g022u,g032u,g042u,g052u,g062u,
     +             g072u,g082u,g092u,g102u,g112u,g122u,
     +             g132u,g142u,g152u,g162u,g172u,g182u,
     +             n1,n2)
c
c Compute the percentage change in total manpower for the average CONUS SBSS.
c
      t1c=((t1b-t1a)/t1a)*100
c
c Compute the percentage change in total manpower for the average overseas SBSS.
c
      t2c=((t2b-t2a)/t2a)*100
c
c Compute the percentage change in total manpower for all CONUS SBSSs in the
c model.
c
      g1c=((g1b-g1a)/g1a)*100
c
c Compute the percentage change in total manpower for all overseas SBSSs in
c the model.
c
      g2c=((g2b-g2a)/g2a)*100
c
c Write output to external file "output".
c
      write(unit=11,fmt=*)'
     +     CONUS ACCOUNTS'
      write(unit=11,fmt=*)''
```

```
 write(unit=11,fmt=*)'                                        AVER
+AGE SBSS MANPOWER FIGURES'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)'                Workcenter                        Pr
+esent Requirement  Projected Requirement  Percent Change'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4100, Chief of Supply
+',w201a,w201b,w201c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4120, Storage and Distribution
+',w011a,w011b,w011c
 write(unit=11,fmt=15)'FAC 4121, Inspection Unit
+',w021a,w021b,w021c
 write(unit=11,fmt=15)'FAC 4122, Receiving Unit
+',w031a,w031b,w031c
 write(unit=11,fmt=15)'FAC 4123, Pickup and Delivery Unit
+',w041a,w041b,w041c
 write(unit=11,fmt=15)'FAC 4124, Storage and Issue Unit
+',w051a,w051b,w051c
 write(unit=11,fmt=15)'FAC 412X, S & D Branch Totals
+',z011a,z011b,z011c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4130, Management and Procedures
+',w101a,w101b,w101c
 write(unit=11,fmt=15)'FAC 4131, Management Analysis Unit
+',w111a,w111b,w111c
 write(unit=11,fmt=15)'FAC 4132, Supply Training Unit
+',w121a,w121b,w121c
 write(unit=11,fmt=15)'FAC 4133, Procedures and Standardization Unit
+',w131a,w131b,w131c
 write(unit=11,fmt=15)'FAC 4134, Funds Management Unit
+',w141a,w141b,w141c
 write(unit=11,fmt=15)'FAC 413X, M & P Branch Totals
+',z051a,z051b,z051c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4140, Material Management
+',w401a,w401b,w401c
 write(unit=11,fmt=15)'FAC 4141A, Stock Control Section
+',w411a,w411b,w411c
 write(unit=11,fmt=15)'FAC 4141B, Requirements Unit
+',w421a,w421b,w421c
 write(unit=11,fmt=15)'FAC 4141C, Requisitioning Unit
+',w431a,w431b,w431c
 write(unit=11,fmt=15)'FAC 4142, MICAP Management Unit
+',w441a,w441b,w441c
 write(unit=11,fmt=15)'FAC 414X, MM Branch Totals
+',z031a,z031b,z031c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4150, Customer Support
+',w301a,w301b,w301c
```

```
 write(unit=11,fmt=15)'FAC 4151, Customer Liason Unit
+',w311a,w311b,w311c
 write(unit=11,fmt=15)'FAC 4152, Material Support Section
+',w321a,w321b,w321c
 write(unit=11,fmt=15)'FAC 4152A, Demand Processing Unit
+',w331a,w331b,w331c
 write(unit=11,fmt=15)'FAC 4152B, Bench Stock Support Unit
+',w341a,w341b,w341c
 write(unit=11,fmt=15)'FAC 4153, Retail Sales Section
+',w351a,w351b,w351c
 write(unit=11,fmt=15)'FAC 4153A, Base Service Store
+',w361a,w361b,w361c
 write(unit=11,fmt=15)'FAC 4153B, Individual Equipment Unit
+',w371a,w371b,w371c
 write(unit=11,fmt=15)'FAC 4154, Allowance and Authorization Unit
+',w381a,w381b,w381c
 write(unit=11,fmt=15)'FAC 415X, CS Branch Totals
+',z021a,z021b,z021c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4160, Systems Management
+',w501a,w501b,w501c
 write(unit=11,fmt=15)'FAC 4161A, ADPM/PCAM Operations Office
+',w511a,w511b,w511c
 write(unit=11,fmt=15)'FAC 4161C, PCAM/Distribution Unit
+',w531a,w531b,w531c
 write(unit=11,fmt=15)'FAC 4162, Records Maintenance Unit
+',w541a,w541b,w541c
 write(unit=11,fmt=15)'FAC 4163, Document Control Unit
+',w551a,w551b,w551c
 write(unit=11,fmt=15)'FAC 4164, Inventory Unit
+',w561a,w561b,w561c
 write(unit=11,fmt=15)'FAC 416X, SM Branch Totals
+',z041a,z041b,z041c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 41XX, Squadron Totals
+',t1a,t1b,t1c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 41XX, System Totals
+',g1a,g1b,g1c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'Number of Bases in System
+',n1
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)'Note: Due to the decimal rounding process som
+e workcenters will show a percentage change but no integer change.
+'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)'
```

```
+SENSITIVITY ANALYSIS'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)'Workload Factor     Total Projected    Total Pro
+jected   Total Projected'
 write(unit=11,fmt=*)'                    Requirement if     Requireme
+nt if    Requirement if'
 write(unit=11,fmt=*)'                    Factor is Over-    Factor is
+ Est-    Factor is Under-'
 write(unit=11,fmt=*)'                    estimated 25%      imated Co
+rrectly  estimated 25%'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=16)'Receipts              ',g011o,glb,g011u
 write(unit=11,fmt=16)'Turn-ins              ',g021o,glb,g021u
 write(unit=11,fmt=16)'Issues                ',g031o,glb,g031u
 write(unit=11,fmt=16)'Shipments             ',g041o,glb,g041u
 write(unit=11,fmt=16)'Item Records          ',g051o,glb,g051u
 write(unit=11,fmt=16)'Reparables            ',g061o,glb,g061u
 write(unit=11,fmt=16)'DORs                  ',g071o,glb,g071u
 write(unit=11,fmt=16)'OCCRs                 ',g081o,glb,g081u
 write(unit=11,fmt=16)'Transactions          ',g091o,glb,g091u
 write(unit=11,fmt=16)'BS Issues,DORs,DOUs',g101o,glb,g101u
 write(unit=11,fmt=16)'BSS/TIC Issues        ',g111o,glb,g111u
 write(unit=11,fmt=16)'IEU Issues            ',g121o,glb,g121u
 write(unit=11,fmt=16)'AFF 601s Processed ',g131o,glb,g131u
 write(unit=11,fmt=16)'Requisitions (-LP) ',g141o,glb,g141u
 write(unit=11,fmt=16)'LP Requisitions       ',g151o,glb,g151u
 write(unit=11,fmt=16)'MICAP Starts          ',g161o,glb,g161u
 write(unit=11,fmt=16)'DCCs                  ',g171o,glb,g171u
 write(unit=11,fmt=16)'Units Inventoried  ',g181o,glb,g181u
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)'
+   OVERSEAS ACCOUNTS'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)'                                              AVER
+AGE SBSS MANPOWER FIGURES'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)'                 Workcenter                   Pr
+esent Requirement  Projected Requirement  Percent Change'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4100, Chief of Supply
+',w202a,w202b,w202c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4120, Storage and Distribution
+',w012a,w012b,w012c
 write(unit=11,fmt=15)'FAC 4121, Inspection Unit
+',w022a,w022b,w022c
 write(unit=11,fmt=15)'FAC 4122, Receiving Unit
+',w032a,w032b,w032c
 write(unit=11,fmt=15)'FAC 4123, Pickup and Delivery Unit
+',w042a,w042b,w042c
 write(unit=11,fmt=15)'FAC 4124, Storage and Issue Unit
```

```
+',w052a,w052b,w052c
 write(unit=11,fmt=15)'FAC 412X, S & D Branch Totals
+',z012a,z012b,z012c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4130, Management and Procedures
+',w102a,w102b,w102c
 write(unit=11,fmt=15)'FAC 4131, Management Analysis Unit
+',w112a,w112b,w112c
 write(unit=11,fmt=15)'FAC 4132, Supply Training Unit
+',w122a,w122b,w122c
 write(unit=11,fmt=15)'FAC 4133, Procedures and Standardization Unit
+',w132a,w132b,w132c
 write(unit=11,fmt=15)'FAC 4134, Funds Management Unit
+',w142a,w142b,w142c
 write(unit=11,fmt=15)'FAC 413X, M & P Branch Totals
+',z052a,z052b,z052c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4140, Material Management
+',w402a,w402b,w402c
 write(unit=11,fmt=15)'FAC 4141A, Stock Control Section
+',w412a,w412b,w412c
 write(unit=11,fmt=15)'FAC 4141B, Requirements Unit
+',w422a,w422b,w422c
 write(unit=11,fmt=15)'FAC 4141C, Requisitioning Unit
+',w432a,w432b,w432c
 write(unit=11,fmt=15)'FAC 4142, MICAP Management Unit
+',w442a,w442b,w442c
 write(unit=11,fmt=15)'FAC 414X, MM Branch Totals
+',z032a,z032b,z032c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4150, Customer Support
+',w302a,w302b,w302c
 write(unit=11,fmt=15)'FAC 4151, Customer Liason Unit
+',w312a,w312b,w312c
 write(unit=11,fmt=15)'FAC 4152, Material Support Section
+',w322a,w322b,w322c
 write(unit=11,fmt=15)'FAC 4152A, Demand Processing Unit
+',w332a,w332b,w332c
 write(unit=11,fmt=15)'FAC 4152B, Bench Stock Support Unit
+',w342a,w342b,w342c
 write(unit=11,fmt=15)'FAC 4153, Retail Sales Section
+',w352a,w352b,w352c
 write(unit=11,fmt=15)'FAC 4153A, Base Service Store
+',w362a,w362b,w362c
 write(unit=11,fmt=15)'FAC 4153B, Individual Equipment Unit
+',w372a,w372b,w372c
 write(unit=11,fmt=15)'FAC 4154, Allowance and Authorization Unit
+',w382a,w382b,w382c
 write(unit=11,fmt=15)'FAC 415X, CS Branch Totals
+',z022a,z022b,z022c
 write(unit=11,fmt=*)''
```

```
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 4160, Systems Management
+',w502a,w502b,w502c
 write(unit=11,fmt=15)'FAC 4161A, ADPM/PCAM Operations Office
+',w512a,w512b,w512c
 write(unit=11,fmt=15)'FAC 4161C, PCAM/Distribution Unit
+',w532a,w532b,w532c
 write(unit=11,fmt=15)'FAC 4162, Records Maintenance Unit
+',w542a,w542b,w542c
 write(unit=11,fmt=15)'FAC 4163, Document Control Unit
+',w552a,w552b,w552c
 write(unit=11,fmt=15)'FAC 4164, Inventory Unit
+',w562a,w562b,w562c
 write(unit=11,fmt=15)'FAC 416X, SM Branch Totals
+',z042a, 42b,z042c
 write(uni 11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 41XX, Squadron Totals
+',t2a,t2b,t2c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'FAC 41XX, System Totals
+',g2a,g2b,g2c
 write(unit=11,fmt=*)''
 write(unit=11,fmt=15)'Number of Bases in System
+',n2
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)'Note: Due to the decimal rounding process som
+e workcenters will show a percentage change but no integer change.
+'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)'
+    SENSITIVITY ANALYSIS'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)''
 write(unit=11,fmt=*)'Workload Factor    Total Projected    Total Pro
+jected   Total Projected'
 write(unit=11,fmt=*)'                  Requirement if     Requireme
+nt if    Requirement if'
 write(unit=11,fmt=*)'                  Factor is Over-    Factor is
+ Est-    Factor is Under-'
 write(unit=11,fmt=*)'                  estimated 25%      imated Co
+rrectly  estimated 25%'
 write(unit=11,fmt=*)''
 write(unit=11,fmt=16)'Receipts          ',g012o,g2b,g012u
 write(unit=11,fmt=16)'Turn-ins          ',g022o,g2b,g022u
 write(unit=11,fmt=16)'Issues            ',g032o,g2b,g032u
 write(unit=11,fmt=16)'Shipments         ',g042o,g2b,g042u
 write(unit=11,fmt=16)'Item Records      ',g052o,g2b,g052u
 write(unit=11,fmt=16)'Reparables        ',g062o,g2b,g062u
 write(unit=11,fmt=16)'DORs              ',g072o,g2b,g072u
```

```
      write(unit=11,fmt=16)'OCCRs                ',g082o,g2b,g082u
      write(unit=11,fmt=16)'Transactions         ',g092o,g2b,g092u
      write(unit=11,fmt=16)'BS Issues,DORs,DOUs',g102o,g2b,g102u
      write(unit=11,fmt=16)'BSS/TIC Issues      ',g112o,g2b,g112u
      write(unit=11,fmt=16)'IEU Issues          ',g122o,g2b,g122u
      write(unit=11,fmt=16)'AFF 601s Processed ',g132o,g2b,g132u
      write(unit=11,fmt=16)'Requisitions (-LP) ',g142o,g2b,g142u
      write(unit=11,fmt=16)'LP Requisitions     ',g152o,g2b,g152u
      write(unit=11,fmt=16)'MICAP Starts        ',g162o,g2b,g162u
      write(unit=11,fmt=16)'DCCs                ',g172o,g2b,g172u
      write(unit=11,fmt=16)'Units Inventoried   ',g182o,g2b,g182u
c
c Format statements.
c
 15   format(1x,a45,2x,f6.0,16x,f6.0,15x,f6.1)
 16   format(1x,a20,t23,f6.0,t42,f6.0,t60,f6.0)
      stop
      end
c
c This subroutine calculates the manpower requirements for the average CONUS
c Material Storage and Distribution Branch and all subunits thereof.
c
      subroutine lgsdc(w011a,w021a,w031a,w041a,w051a,z011a,
     +                 w011b,w021b,w031b,w041b,w051b,z011b,
     +                 w011c,w021c,w031c,w041c,w051c,z011c,
     +                 x011a,x021a,x031a,x041a,x051a,x061a,x071a,
     +                 x011b,x021b,x031b,x041b,x051b,x061b,x071b,
     +                 y011a,y021a,y031a,y041a,y051a,
     +                 y011b,y021b,y031b,y041b,y051b)
c
c Declare variables.
c
      real w011a,w021a,w031a,w041a,w051a,z011a,
     +     w011b,w021b,w031b,w041b,w051b,z011b,
     +     w011c,w021c,w031c,w041c,w051c,z011c,
     +     x011a,x021a,x031a,x041a,x051a,x061a,x071a,
     +     x011b,x021b,x031b,x041b,x051b,x061b,x071b,
     +     y011a,y021a,y031a,y041a,y051a,
     +     y011b,y021b,y031b,y041b,y051b
c
c Compute manhours required for FACs 4121, 4122, 4123, 4124.
c
      y021a=9.851*(x011a+x021a)**.5227
      y021b=9.851*(x011b+x021b)**.5227
      y031a=574.71+.2143*x011a
      y031b=574.71+.2143*x011b
      y041a=(x021a+x031a+x041a+x071a)/
     +     (3.847+.0001818*(x021a+x031a+x041a+x071a))
      y041b=(x021b+x031b+x041b+x071b)/
     +     (3.847+.0001818*(x021b+x031b+x041b+x071b))
      y051a=1463.66+.1323*(x011a+x021a+x061a)
      y051b=1463.66+.1323*(x011b+x021b+x061b)
c
c Compute manpower required for FACs 4121, 4122, 4123, 4124.
```

```
c
      w021a=y021a/145.2
      w021b=y021b/145.2
      w031a=y031a/145.2
      w031b=y031b/145.2
      w041a=y041a/145.2
      w041b=y041b/145.2
      w051a=y051a/145.2
      w051b=y051b/145.2
c
c Compute manhours required for FAC 4120.
c
      y011a=64.93*(w021a+w031a+w041a+w051a)**.3806
      y011b=64.93*(w021b+w031b+w041b+w051b)**.3806
c
c Compute manpower required for FAC 4120.
c
      w011a=y011a/145.2
      w011b=y011b/145.2
c
c Compute total manpower required for the Branch.
c
      z011a=w011a+w021a+w031a+w041a+w051a
      z011b=w011b+w021b+w031b+w041b+w051b
c
c Compute the percentage change in manpower for the Branch and all subunits
c thereof.
c
      w011c=((w011b-w011a)/w011a)*100
      w021c=((w021b-w021a)/w021a)*100
      w031c=((w031b-w031a)/w031a)*100
      w041c=((w041b-w041a)/w041a)*100
      w051c=((w051b-w051a)/w051a)*100
      z011c=((z011b-z011a)/z011a)*100
      return
      end
c
c This subroutine calculates the manpower requirements for the average overseas
c Material Storage and Distribution Branch and all subunits thereof. Note that
c it is structured identically to subroutine lgsdc. Please refer to that sub-
c routine for questions concerning documentation.
c
      subroutine lgsdo(w012a,w022a,w032a,w042a,w052a,z012a,
     +                 w012b,w022b,w032b,w042b,w052b,z012b,
     +                 w012c,w022c,w032c,w042c,w052c,z012c,
     +                 x012a,x022a,x032a,x042a,x052a,x062a,x072a,
     +                 x012b,x022b,x032b,x042b,x052b,x062b,x072b,
     +                 y012a,y022a,y032a,y042a,y052a,
     +                 y012b,y022b,y032b,y042b,y052b)
      real w012a,w022a,w032a,w042a,w052a,z012a,
     +     w012b,w022b,w032b,w042b,w052b,z012b,
     +     w012c,w022c,w032c,w042c,w052c,z012c,
     +     x012a,x022a,x032a,x042a,x052a,x062a,x072a,
     +     x012b,x022b,x032b,x042b,x052b,x062b,x072b,
```

```
     +     y012a,y022a,y032a,y042a,y052a,
     +     y012b,y022b,y032b,y042b,y052b
      y022a=9.851*(x012a+x022a)**.5227
      y022b=9.851*(x012b+x022b)**.5227
      y032a=398.814+.3438*x012a
      y032b=398.814+.3438*x012b
      y042a=(x022a+x032a+x042a+x072a)/
     +     (3.847+.0001818*(x022a+x032a+x042a+x072a))
      y042b=(x022b+x032b+x042b+x072b)/
     +     (3.847+.0001818*(x022b+x032b+x042b+x072b))
      y052a=-956.2+.6983*x012a
      y052b=-956.2+.6983*x012b
      w022a=y022a/143.5
      w022b=y022b/143.5
      w032a=y032a/143.5
      w032b=y032b/143.5
      w042a=y042a/143.5
      w042b=y042b/143.5
      w052a=y052a/143.5
      w052b=y052b/143.5
      y012a=64.93*(w022a+w032a+w042a+w052a)**.3806
      y012b=64.93*(w022b+w032b+w042b+w052b)**.3806
      w012a=y012a/143.5
      w012b=y012b/143.5
      z012a=w012a+w022a+w032a+w042a+w052a
      z012b=w012b+w022b+w032b+w042b+w052b
      w012c=((w012b-w012a)/w012b)*100
      w022c=((w022b-w022a)/w022b)*100
      w032c=((w032b-w032a)/w032b)*100
      w042c=((w042b-w042a)/w042b)*100
      w052c=((w052b-w052a)/w052b)*100
      z012c=((z012b-z012a)/z012a)*100
      return
      end
c
c This subroutine computes the manpower requirements for the average CONUS
c Customer Support Branch and all subunits thereof.
c
      subroutine lgscc(w301a,w311a,w321a,w331a,w341a,w351a,w361a,w371a,
     +                 w301b,w311b,w321b,w331b,w341b,w351b,w361b,w371b,
     +                 w301c,w311c,w321c,w331c,w341c,w351c,w361c,w371c,
     +                 w381a,
     +                 w381b,
     +                 w381c,
     +                 x081a,x091a,x101a,x111a,x121a,x131a,
     +                 x081b,x091b,x101b,x111b,x121b,x131b,
     +                 y301a,y311a,y321a,y331a,y341a,y351a,y361a,y371a,
     +                 y301b,y311b,y321b,y331b,y341b,y351b,y361b,y371b,
     +                 y381a,
     +                 y381b,
     +                 z021a,
     +                 z021b,
     +                 z021c)
c
```

```
c Declare variables.
c
      real w301a,w311a,w321a,w331a,w341a,w351a,w361a,w371a,w381a,
     +     w301b,w311b,w321b,w331b,w341b,w351b,w361b,w371b,w381b,
     +     w301c,w311c,w321c,w331c,w341c,w351c,w361c,w371c,w381c,
     +     x081a,x091a,x101a,x111a,x121a,x131a,
     +     x081b,x091b,x101b,x111b,x121b,x131b,
     +     y301a,y311a,y321a,y331a,y341a,y351a,y361a,y371a,y381a,
     +     y301b,y311b,y321b,y331b,y341b,y351b,y361b,y371b,y381b,
     +     z021a,
     +     z021b,
     +     z021c
c
c Compute the manhours required for FACs 4151, 4152A, 4152B, 4153A, 4153B,
c and 4154.
c
      y311a=47.07+.5668*x081a
      y311b=47.07+.5668*x081b
      y331a=337.3+.01605*x091a
      y331b=337.3+.01605*x091b
      y341a=323.4+.1472*x101a
      y341b=323.4+.1472*x101b
      y361a=123.6+.1166*x111a
      y361b=123.6+.1166*x111b
      y371a=290.4+.2722*x121a
      y371b=290.4+.2722*x121b
      y381a=531.1+1.421*x131a
      y381b=531.1+1.421*x131b
c
c Compute the manpower required for FACs 4151, 4152A, 4152B, 4153A, 4153B,
c and 4154.
c
      w311a=y311a/145.2
      w311b=y311b/145.2
      w331a=y331a/145.2
      w331b=y331b/145.2
      w341a=y341a/145.2
      w341b=y341b/145.2
      w361a=y361a/145.2
      w361b=y361b/145.2
      w371a=y371a/145.2
      w371b=y371b/145.2
      w381a=y381a/145.2
      w381b=y381b/145.2
c
c Compute the manhours required for FAC 4152.
c
      y321a=29.82+4.946*(w331a+w341a)
      y321b=29.82+4.946*(w331b+w341b)
c
c Compute the manpower required for FAC 4152.
c
      w321a=y321a/145.2
      w321b=y321b/145.2
```

```
c
c Manpower required for FAC 4153, note that no calculationfor this figure
c is required.
c
      w351a=1
      w351b=1
c
c Compute the manhours required for FAC 4150.
c
      y301a=264.8+1.975*(w311a+w321a+w331a+w341a+w351a+w361a+w371a+
     +                   w381a)
      y301b=264.8+1.975*(w311b+w321b+w331b+w341b+w351b+w361b+w371b+
     +                   w381b)
c
c Compute the manpower required for FAC 4150.
c
      w301a=y301a/145.2
      w301b=y301b/145.2
c
c Compute manpower required for the branch.
c
      z021a=w301a+w311a+w321a+w331a+w341a+w351a+w361a+w371a+w381a
      z021b=w301b+w311b+w321b+w331b+w341b+w351b+w361b+w371b+w381b
c
c Compute the percentage change in manpower for the branch and all subunits
c thereof.
c
      w301c=((w301b-w301a)/w301a)*100
      w311c=((w311b-w311a)/w311a)*100
      w321c=((w321b-w321a)/w321a)*100
      w331c=((w331b-w331a)/w331a)*100
      w341c=((w341b-w341a)/w341a)*100
      w351c=((w351b-w351a)/w351a)*100
      w361c=((w361b-w361a)/w361a)*100
      w371c=((w371b-w371a)/w371a)*100
      w381c=((w381b-w381a)/w381a)*100
      z021c=((z021b-z021a)/z021a)*100
      return
      end
c
c This subroutine calculates the manpower requirements for the average overseas
c Customer Support Branch and all subunits thereof. Note that it is structured
c identically to subroutine lgscc. Please refer to that subroutine for ques-
c tions concerning documentation.
c
      subroutine lgsco(w302a,w312a,w322a,w332a,w342a,w352a,w362a,w372a,
     +                 w302b,w312b,w322b,w332b,w342b,w352b,w362b,w372b,
     +                 w302c,w312c,w322c,w332c,w342c,w352c,w362c,w372c,
     +                 w382a,
     +                 w382b,
     +                 w382c,
     +                 x082a,x092a,x102a,x112a,x122a,x132a,
     +                 x082b,x092b,x102b,x112b,x122b,x132b,
     +                 y302a,y312a,y322a,y332a,y342a,y352a,y362a,y372a,
```

```
+               y302b,y312b,y322b,y332b,y342b,y352b,y362b,y372b,
+               y382a,
+               y382b,
+               z022a,
+               z022b,
+               z022c)
 real w302a,w312a,w322a,w332a,w342a,w352a,w362a,w372a,w382a,
+     w302b,w312b,w322b,w332b,w342b,w352b,w362b,w372b,w382b,
+     w302c,w312c,w322c,w332c,w342c,w352c,w362c,w372c,w382c,
+     x082a,x092a,x102a,x112a,x122a,x132a,
+     x082b,x092b,x102b,x112b,x122b,x132b,
+     y302a,y312a,y322a,y332a,y342a,y352a,y362a,y372a,y382a,
+     y302b,y312b,y322b,y332b,y342b,y352b,y362b,y372b,y382b,
+     z022a,
+     z022b,
+     z022c
 y312a=47.07+.5668*x082a
 y312b=47.07+.5668*x082b
 y332a=337.3+.01605*x092a
 y332b=337.3+.01605*x092b
 y342a=323.4+.1472*x102a
 y342b=323.4+.1472*x102b
 y362a=123.6+.1166*x112a
 y362b=123.6+.1166*x112b
 y372a=290.4+.2722*x122a
 y372b=290.4+.2722*x122b
 y382a=531.1+1.421*x132a
 y382b=531.1+1.421*x132b
 w312a=y312a/143.5
 w312b=y312b/143.5
 w332a=y332a/143.5
 w332b=y332b/143.5
 w342a=y342a/143.5
 w342b=y342b/143.5
 w362a=y362a/143.5
 w362b=y362b/143.5
 w372a=y372a/143.5
 w372b=y372b/143.5
 w382a=y382a/143.5
 w382b=y382b/143.5
 y322a=29.82+4.946*(w332a+w342a)
 y322b=29.82+4.946*(w332b+w342b)
 w322a=y322a/143.5
 w322b=y322b/143.5
 w352a=1
 w352b=1
 y302a=264.8+1.975*(w312a+w322a+w332a+w342a+w352a+w362a+w372a+
+                     w382a)
 y302b=264.8+1.975*(w312b+w322b+w332b+w342b+w352b+w362b+w372b+
+                     w382b)
 w302a=y302a/143.5
 w302b=y302b/143.5
 z022a=w302a+w312a+w322a+w332a+w342a+w352a+w362a+w372a+w382a
 z022b=w302b+w312b+w322b+w332b+w342b+w352b+w362b+w372b+w382b
```

```
      w302c=((w302b-w302a)/w302a)*100
      w312c=((w312b-w312a)/w312a)*100
      w322c=((w322b-w322a)/w322a)*100
      w332c=((w332b-w332a)/w332a)*100
      w342c=((w342b-w342a)/w342a)*100
      w352c=((w352b-w352a)/w352a)*100
      w362c=((w362b-w362a)/w362a)*100
      w372c=((w372b-w372a)/w372a)*100
      w382c=((w382b-w382a)/w382a)*100
      z022c=((z022b-z022a)/z022a)*100
      return
      end
c
c This subroutine calculate the manpower requirements for the average CONUS
c Material Management Branch and all subunits thereof.
c
      subroutine lgsmc (w401a,w411a,w421a,w431a,w441a,
     +                  w401b,w411b,w421b,w431b,w441b,
     +                  w401c,w411c,w421c,w431c,w441c,
     +                  x091a,x141a,x151a,x161a,
     +                  x091b,x141b,x151b,x161b,
     +                  y401a,y411a,y421a,y431a,y441a,
     +                  y401b,y411b,y421b,y431b,y441b,
     +                  z031a,
     +                  z031b,
     +                  z031c)
c
c Declare variables.
c
      real w401a,w411a,w421a,w431a,w441a,
     +     w401b,w411b,w421b,w431b,w441b,
     +     w401c,w411c,w421c,w431c,w441c,
     +     x091a,x141a,x151a,x161a,
     +     x091b,x141b,x151b,x161b,
     +     y401a,y411a,y421a,y431a,y441a,
     +     y401b,y411b,y421b,y431b,y441b,
     +     z031a,
     +     z031b,
     +     z031c
c
c Compute manhours required for FACs 4141B, 4141C, and 4142.
c
      y421a=x091a/(91.65+.0004294*x091a)
      y421b=x091b/(91.65+.0004294*x091a)
      y431a=379.7+.09203*x141a+.1447*x151a
      y431b=379.7+.09203*x141b+.1447*x151b
      y441a=17.32*x161a**.6374
      y441b=17.32*x161b**.6374
c
c Compute manpower required for FACs 4141B, 4141C, and 4142.
c
      w421a=y421a/145.2
      w421b=y421b/145.2
      w431a=y431a/145.2
```

```
      w431b=y431b/145.2
      w441a=y441a/145.2
      w441b=y441b/145.2
c
c Compute manhours required for FAC 4141A.
c
      y411a=(w421a+w431a)/(.02374+.004868*(w421a+w431a))
      y411b=(w421b+w431b)/(.02374+.004868*(w421b+w431b))
c
c Compute manpower required for FAC 4141A.
c
      w411a=y411a/145.2
      w411b=y411b/145.2
c
c Compute manhours required for FAC 4140.
c
      y401a=219.36+4.557*(w411a+w421a+w431a+w441a)
      y401b=219.36+4.557*(w411b+w421b+w431b+w441b)
c
c Compute manpower required for FAC 4140.
c
      w401a=y401a/145.2
      w401b=y401b/145.2
c
c Compute manpower required for branch.
c
      z031a=w401a+w411a+w421a+w431a+w441a
      z031b=w401b+w411b+w421b+w431b+w441b
c
c Compute percentage change in manpower required for the branch and all
c subunits thereof.
c
      w401c=((w401b-w401a)/w401a)*100
      w411c=((w411b-w411a)/w411a)*100
      w421c=((w421b-w421a)/w421a)*100
      w431c=((w431b-w431a)/w431a)*100
      w441c=((w441b-w441a)/w441a)*100
      z031c=((z031b-z031a)/z031a)*100
      return
      end
c
c This subroutine computes the manpower requirements for the average overeseas
c Material Management Branch, and all subunits thereof. Note that it is struc-
c tured identically to subroutine lgsmc. Please refer to that subroutine for
c questions concerning documentation.
c
      subroutine lgsmo (w402a,w412a,w422a,w432a,w442a,
     +                  w402b,w412b,w422b,w432b,w442b,
     +                  w402c,w412c,w422c,w432c,w442c,
     +                  x092a,x142a,x152a,x162a,
     +                  x092b,x142b,x152b,x162b,
     +                  y402a,y412a,y422a,y432a,y442a,
     +                  y402b,y412b,y422b,y432b,y442b,
     +                  z032a,
```

```
+                        z032b,
+                        z032c)
 real w402a,w412a,w422a,w432a,w442a,
+     w402b,w412b,w422b,w432b,w442b,
+     w402c,w412c,w422c,w432c,w442c,
+     x092a,x142a,x152a,x162a,
+     x092b,x142b,x152b,x162b,
+     y402a,y412a,y422a,y432a,y442a,
+     y402b,y412b,y422b,y432b,y442b,
+     z032a,
+     z032b,
+     z032c
  y422a=x092a/(91.65+.0004294*x092a)
  y422b=x092a/(91.65+.0004294*x092b)
  y432a=379.7+.09203*x142a+.1447*x152a
  y432b=379.7+.09203*x142b+.1447*x152b
  y442a=17.32*x162a**.6374
  y442b=17.32*x162b**.6374
  w422a=y422a/143.5
  w422b=y422b/143.5
  w432a=y432a/143.5
  w432b=y432b/143.5
  w442a=y442a/143.5
  w442b=y442b/143.5
  y412a=(w422a+w432a)/(.02374+.004868*(w422a+w432a))
  y412b=(w422b+w432b)/(.02374+.004868*(w422b+w432b))
  w412a=y412a/143.5
  w412b=y412b/143.5
  y402a=219.36+4.557*(w412a+w422a+w432a+w442a)
  y402b=219.36+4.557*(w412b+w422b+w432b+w442b)
  w402a=y402a/143.5
  w402b=y402b/143.5
  z032a=w402a+w412a+w422a+w432a+w442a
  z032b=w402b+w412b+w422b+w432b+w442b
  w402c=((w402b-w402a)/w402a)*100
  w412c=((w412b-w412a)/w412a)*100
  w422c=((w422b-w422a)/w422a)*100
  w432c=((w432b-w432a)/w432a)*100
  w442c=((w442b-w442a)/w442a)*100
  z032c=((z032b-z032a)/z032a)*100
  return
  end
c
c This subroutine calculates the manpower requirements for the average CONUS
c Supply Systems Branch and all subunits thereof.
c
      subroutine lgssc (w501a,w511a,w521a,w531a,w541a,w551a,w561a,
     +                  w501b,w511b,w521b,w531b,w541b,w551b,w561b,
     +                  w501c,w511c,w521c,w531c,w541c,w551c,w561c,
     +                  x051a,x091a,x171a,x181a,
     +                  x051b,x091b,x171b,x181b,
     +                  y501a,y511a,y521a,y531a,y541a,y551a,y561a,
     +                  y501b,y511b,y521b,y531b,y541b,y551b,y561b,
     +                  z041a,
```

```
     +                    z041b,
     +                    z041c)
c
c Declare variables.
c
      real w501a,w511a,w521a,w531a,w541a,w551a,w561a,
     +     w501b,w511b,w521b,w531b,w541b,w551b,w561b,
     +     w501c,w511c,w521c,w531c,w541c,w551c,w561c,
     +     x051a,x091a,x171a,x181a,
     +     x051b,x091b,x171b,x181b,
     +     y501a,y511a,y521a,y531a,y541a,y551a,y561a,
     +     y501b,y511b,y521b,y531b,y541b,y551b,y561b,
     +     z041a,
     +     z041b,
     +     z041c
c
c Compute manhours required for FACs 4161C, 4162, 4163, and 4164.
c
      y531a=62.9+.005584*x091a
      y531b=62.9+.005584*x091b
      y541a=194.62+.005922*x051a
      y541b=194.62+.005922*x051b
      y551a=74.4+.025*x171a
      y551b=74.4+.025*x171b
      y561a=159.7+.005228*x181a
      y561b=159.7+.005228*x181b
c
c Compute manpower required for FACs 4161C, 4162, 4163, and 4164.
c
      w531a=y531a/145.2
      w531b=y531b/145.2
      w541a=y541a/145.2
      w541b=y541b/145.2
      w551a=y551a/145.2
      w551b=y551b/145.2
      w561a=y561a/145.2
      w561b=y561b/145.2
c
c Compute manhours required for FAC 4161A.
c
      y511a=121.3+9.335*(w521a+w531a)
      y511b=121.3+9.335*(w521b+w531b)
c
c Compute manpower required for FAC 4161A.
c
      w511a=y511a/145.2
      w511b=y511b/145.2
c
c Compute manhours required for FAC 4160.
c
      y501a=98.07+4.738*(w511a+w521a+w531a+w541a+w551a+w561a)
      y501b=98.07+4.738*(w511b+w521b+w531b+w541b+w551b+w561b)
c
c Compute manpower required for FAC 4160.
```

```
c
      w501a=y501a/145.2
      w501b=y501b/145.2
c
c Compute manpower required for the branch.
c
      z041a=w501a+w511a+w521a+w531a+w541a+w551a+w561a
      z041b=w501b+w511b+w521b+w531b+w541b+w551b+w561b
c
c Compute the percentage change in manpower required for the branch and all
c subunits thereof.
c
      w501c=((w501b-w501a)/w501a)*100
      w511c=((w511b-w511a)/w511a)*100
      w531c=((w531b-w531a)/w531a)*100
      w541c=((w541b-w541a)/w541a)*100
      w551c=((w551b-w551a)/w551a)*100
      w561c=((w561b-w561a)/w561a)*100
      z041c=((z041b-z041a)/z041a)*100
      return
      end
c
c This subroutine computes the manpower requirements for the average overseas
c Supply Systems Branch and all subunits thereof. Note that it is structured
c identically to subroutine lgssc. Please refer to that subroutine for any
c questions concerning documentation.
c
      subroutine lgsso (w502a,w512a,w522a,w532a,w542a,w552a,w562a,
     +                  w502b,w512b,w522b,w532b,w542b,w552b,w562b,
     +                  w502c,w512c,w522c,w532c,w542c,w552c,w562c,
     +                  x052a,x092a,x172a,x182a,
     +                  x052b,x092b,x172b,x182b,
     +                  y502a,y512a,y522a,y532a,y542a,y552a,y562a,
     +                  y502b,y512b,y522b,y532b,y542b,y552b,y562b,
     +                  z042a,
     +                  z042b,
     +                  z042c)
      real w502a,w512a,w522a,w532a,w542a,w552a,w562a,
     +     w502b,w512b,w522b,w532b,w542b,w552b,w562b,
     +     w502c,w512c,w522c,w532c,w542c,w552c,w562c,
     +     x052a,x092a,x172a,x182a,
     +     x052b,x092b,x172b,x182b,
     +     y502a,y512a,y522a,y532a,y542a,y552a,y562a,
     +     y502b,y512b,y522b,y532b,y542b,y552b,y562b,
     +     z042a,
     +     z042b,
     +     z042c
      y532a=62.9+.005584*x092a
      y532b=62.9+.005584*x092b
      y542a=194.62+.005922*x052a
      y542b=194.62+.005922*x052b
      y552a=74.4+.025*x172a
      y552b=74.4+.025*x172b
      y562a=159.7+.005228*x182a
```

```
      y562b=159.7+.005228*x182b
      w532a=y532a/143.5
      w532b=y532b/143.5
      w542a=y542a/143.5
      w542b=y542b/143.5
      w552a=y552a/143.5
      w552b=y552b/143.5
      w562a=y562a/143.5
      w562b=y562b/143.5
      y512a=121.3+9.335*(w522a+w532a)
      y512b=121.3+9.335*(w522b+w532b)
      w512a=y512a/143.5
      w512b=y512b/143.5
      y502a=98.07+4.738*(w512a+w522a+w532a+w542a+w552a+w562a)
      y502b=98.07+4.738*(w512b+w522b+w532b+w542b+w552b+w562b)
      w502a=y502a/143.5
      w502b=y502b/143.5
      z042a=w502a+w512a+w522a+w532a+w542a+w552a+w562a
      z042b=w502b+w512b+w522b+w532b+w542b+w552b+w562b
      w502c=((w502b-w502a)/w502a)*100
      w512c=((w512b-w512a)/w512a)*100
      w532c=((w532b-w532a)/w532a)*100
      w542c=((w542b-w542a)/w542a)*100
      w552c=((w552b-w552a)/w552a)*100
      w562c=((w562b-w562a)/w562a)*100
      z042c=((z042b-z042a)/z042a)*100
      return
      end
c
c This subroutine computes the manpower requirements for the average CONUS
c Management and Procedures Branch and all subunits thereof.
c
      subroutine lgspc (w101a,w111a,w121a,w131a,w141a,
     +                  w101b,w111b,w121b,w131b,w141b,
     +                  w101c,w111c,w121c,w131c,w141c,
     +                  x051a,x081a,x091a,
     +                  x051b,x081b,x091b,
     +                  y101a,y111a,y121a,y131a,y141a,
     +                  y101b,y111b,y121b,y131b,y141b,
     +                  z011a,z021a,z031a,z041a,z051a,
     +                  z011b,z021b,z031b,z041b,z051b,
     +                  z051c)
c
c Declare variables.
c
      real w101a,w111a,w121a,w131a,w141a,
     +     w101b,w111b,w121b,w131b,w141b,
     +     w101c,w111c,w121c,w131c,w141c,
     +     x051a,x081a,x091a,
     +     x051b,x081b,x091b,
     +     y101a,y111a,y121a,y131a,y141a,
     +     y101b,y111b,y121b,y131b,y141b,
     +     z011a,z021a,z031a,z041a,z051a,
     +     z011b,z021b,z031b,z041b,z051b,
```

```
     +     z051c
c
c Compute the manhour requirement for FAC 4134.
c
      y141a=187.8+.001801*x091a
      y141b=187.8+.001801*x091b
c
c Compute the manpower requirement for FAC 4134.
c
      w141a=y141a/145.2
      w141b=y141b/145.2
c
c Compute the manhour requirement for FAC 4133.
c
      y131a=209.9+.004032*x051a+.5006*(z011a+z021a+z031a+z041a+w141a)
      y131b=209.9+.004032*x051b+.5006*(z011b+z021b+z031b+z041b+w141b)
c
c Compute the manpower requirement for FAC 4133.
c
      w131a=y131a/145.2
      w131b=y131b/145.2
c
c Compute the manhour requirement for FAC 4132.
c
      y121a=57.93+.4928*(z011a+z021a+z031a+z041a+w131a+w141a)+.2426
     +*x081a
      y121b=57.93+.4928*(z011b+z021b+z031b+z041b+w131b+w141b)+.2426
     +*x081b
c
c Compute the manpower requirement for FAC 4132.
c
      w121a=y121a/145.2
      w121b=y121b/145.2
c
c Compute the manhour requirement for FAC 4131.
c
      y111a=167.1+.1756*(z011a+z021a+z031a+z041a+w121a+w131a+w141a)+
     +      .0006292*x091a
      y111b=167.1+.1756*(z011b+z021b+z031b+z041b+w121b+w131b+w141b)+
     +      .0006292*x091b
c
c Compute the manpower requirement for FAC 4131.
c
      w111a=y111a/145.2
      w111b=y111b/145.2
c
c Compute the manhour requirement for FAC 4130.
c
      y101a=218.9+12.04*(w111a+w121a+w131a+w141a)
      y101b=218.9+12.04*(w111b+w121b+w131b+w141b)
c
c Compute the manpower requirement for FAC 4130.
c
      w101a=y101a/145.2
```

```
      w101b=y101b/145.2
c
c Compute the manpower requirement for the branch.
c
      z051a=w101a+w111a+w121a+w131a+w141a
      z051b=w101b+w111b+w121b+w131b+w141b
c
c Compute the percentage change in manpower requirements for the branch and
c all subunits thereof.
c
      w101c=((w101b-w101a)/w101a)*100
      w111c=((w111b-w111a)/w111a)*100
      w121c=((w121b-w121a)/w121a)*100
      w131c=((w131b-w131a)/w131a)*100
      w141c=((w141b-w141a)/w141a)*100
      z051c=((z051b-z051a)/z051a)*100
      return
      end
c
c This subroutine computes the manpower requirements for the average overseas
c Management and Procedures Branch and all subunits thereof. Note that it is
c structured identically to the subroutine lgspc. Please refer to that sub-
c routine for questions concerning documentation.
c
      subroutine lgspo (w102a,w112a,w122a,w132a,w142a,
     +                  w102b,w112b,w122b,w132b,w142b,
     +                  w102c,w112c,w122c,w132c,w142c,
     +                  x052a,x082a,x092a,
     +                  x052b,x082b,x092b,
     +                  y102a,y112a,y122a,y132a,y142a,
     +                  y102b,y112b,y122b,y132b,y142b,
     +                  z012a,z022a,z032a,z042a,z052a,
     +                  z012b,z022b,z032b,z042b,z052b,
     +                  z052c)
      real w102a,w112a,w122a,w132a,w142a,
     +     w102b,w112b,w122b,w132b,w142b,
     +     w102c,w112c,w122c,w132c,w142c,
     +     x052a,x082a,x092a,
     +     x052b,x082b,x092b,
     +     y102a,y112a,y122a,y132a,y142a,
     +     y102b,y112b,y122b,y132b,y142b,
     +     z012a,z022a,z032a,z042a,z052a,
     +     z012b,z022b,z032b,z042b,z052b,
     +     z052c
      y142a=187.8+.001801*x092a
      y142b=187.8+.001801*x092b
      w142a=y142a/143.5
      w142b=y142b/143.5
      y132a=209.9+.004032*x052a+.5006*(z012a+z022a+z032a+z042a+w142a)
      y132b=209.9+.004032*x052b+.5006*(z012b+z022b+z032b+z042b+w142b)
      w132a=y132a/143.5
      w132b=y132b/143.5
      y122a=57.93+.4928*(z012a+z022a+z032a+z042a+w132a+w142a)+.2426
     +*x082a
```

```
      y122b=57.93+.4928*(z012b+z022b+z032b+z042b+w132b+w142b)+.2426
     +*x082b
      w122a=y122a/143.5
      w122b=y122b/143.5
      y112a=167.1+.1756*(z012a+z022a+z032a+z042a+w122a+w132a+w142a)+
     +      .0006292*x092a
      y112b=167.1+.1756*(z012b+z022b+z032b+z042b+w122b+w132b+w142b)+
     +      .0006292*x092b
      w112a=y112a/143.5
      w112b=y112b/143.5
      y102a=218.9+12.04*(w112a+w122a+w132a+w142a)
      y102b=218.9+12.04*(w112b+w122b+w132b+w142b)
      w102a=y102a/145.2
      w102b=y102b/145.2
      z052a=w102a+w112a+w122a+w132a+w142a
      z052b=w102b+w112b+w122b+w132b+w142b
      w102c=((w102b-w102a)/w102a)*100
      w112c=((w112b-w112a)/w112a)*100
      w122c=((w122b-w122a)/w122a)*100
      w132c=((w132b-w132a)/w132a)*100
      w142c=((w142b-w142a)/w142a)*100
      z052c=((z052b-z052a)/z052a)*100
      return
      end
c
c This subroutine computes the sensitivity of the total projected require-
c ments for the system to errors in the estimated workload factor statistics.
c
      subroutine sentvy(x011b,x021b,x031b,x041b,x051b,x061b,x071b,x081b,
     +                  x091b,x101b,x111b,x121b,x131b,x141b,x151b,x161b,
     +                  x171b,x181b,
     +                  x012b,x022b,x032b,x042b,x052b,x072b,x082b,
     +                  x092b,x102b,x112b,x122b,x132b,x142b,x152b,x162b,
     +                  x172b,x182b,
     +                  g1b,g2b,
     +                  g011o,g021o,g031o,g041o,g051o,g061o,
     +                  g071o,g081o,g091o,g101o,g111o,g121o,
     +                  g131o,g141o,g151o,g161o,g171o,g181o,
     +                  g011u,g021u,g031u,g041u,g051u,g061u,
     +                  g071u,g081u,g091u,g101u,g111u,g121u,
     +                  g131u,g141u,g151u,g161u,g171u,g181u,
     +                  g012o,g022o,g032o,g042o,g052o,g062o,
     +                  g072o,g082o,g092o,g102o,g112o,g122o,
     +                  g132o,g142o,g152o,g162o,g172o,g182o,
     +                  g012u,g022u,g032u,g042u,g052u,g062u,
     +                  g072u,g082u,g092u,g102u,g112u,g122u,
     +                  g132u,g142u,g152u,g162u,g172u,g182u,
     +                  n1,n2)
c
c Declare variables.
c
      real x011b,x021b,x031b,x041b,x051b,x061b,x071b,x081b,
     +     x091b,x101b,x111b,x121b,x131b,x141b,x151b,x161b,
     +     x171b,x181b,
```

```
     +      x012b,x022b,x032b,x042b,x052b,x072b,x082b,
     +      x092b,x102b,x112b,x122b,x132b,x142b,x152b,x162b,
     +      x172b,x182b,
     +      g1b,g2b,
     +      g011o,g021o,g031o,g041o,g051o,g061o,
     +      g071o,g081o,g091o,g101o,g111o,g121o,
     +      g131o,g141o,g151o,g161o,g171o,g181o,
     +      g011u,g021u,g031u,g041u,g051u,g061u,
     +      g071u,g081u,g091u,g101u,g111u,g121u,
     +      g131u,g141u,g151u,g161u,g171u,g181u,
     +      g012o,g022o,g032o,g042o,g052o,g062o,
     +      g072o,g082o,g092o,g102o,g112o,g122o,
     +      g132o,g142o,g152o,g162o,g172o,g182o,
     +      g012u,g022u,g032u,g042u,g052u,g062u,
     +      g072u,g082u,g092u,g102u,g112u,g122u,
     +      g132u,g142u,g152u,g162u,g172u,g182u,
     +      n1,n2
c
c Compute a 25% error in the workload factor statistics.
c
      x011b=x011b*.25
      x021b=x021b*.25
      x031b=x031b*.25
      x041b=x041b*.25
      x051b=x051b*.25
      x061b=x061b*.25
      x071b=x071b*.25
      x081b=x081b*.25
      x091b=x091b*.25
      x101b=x101b*.25
      x111b=x111b*.25
      x121b=x121b*.25
      x131b=x131b*.25
      x141b=x141b*.25
      x151b=x151b*.25
      x161b=x161b*.25
      x171b=x171b*.25
      x181b=x181b*.25
      x012b=x012b*.25
      x022b=x022b*.25
      x032b=x032b*.25
      x042b=x042b*.25
      x052b=x052b*.25
      x072b=x072b*.25
      x082b=x082b*.25
      x092b=x092b*.25
      x102b=x102b*.25
      x112b=x112b*.25
      x122b=x122b*.25
      x132b=x132b*.25
      x142b=x142b*.25
      x152b=x152b*.25
      x162b=x162b*.25
      x172b=x172b*.25
```

```
      x182b=x182b*.25
c
c Compute the total projected requirement if the factor is overestimated by
c 25%, CONUS accounts.
c
      g011o=g1b-(n1*(x011b*.0028447))
      g021o=g1b-(n1*(x021b*.0027024))
      g031o=g1b-(n1*(x031b*.0013678))
      g041o=g1b-(n1*(x041b*.0013678))
      g051o=g1b-(n1*(x051b*.000073))
      g061o=g1b-(n1*(x061b*.0009323))
      g071o=g1b-(n1*(x071b*.0013678))
      g081o=g1b-(n1*(x081b*.0058307))
      g091o=g1b-(n1*(x091b*.0002207))
      g101o=g1b-(n1*(x101b*.0010763))
      g111o=g1b-(n1*(x111b*.0008252))
      g121o=g1b-(n1*(x121b*.0019265))
      g131o=g1b-(n1*(x131b*.0100118))
      g141o=g1b-(n1*(x141b*.0006841))
      g151o=g1b-(n1*(x151b*.0010758))
      g161o=g1b-(n1*(x161b*.0067993))
      g171o=g1b-(n1*(x171b*.0001802))
      g181o=g1b-(n1*(x181b*.0000376))
c
c Compute the total estimated requirement if the factor is underestimated by
c 25%, CONUS accounts.
c
      g011u=g1b+(n1*(x011b*.0028447))
      g021u=g1b+(n1*(x021b*.0027024))
      g031u=g1b+(n1*(x031b*.0013678))
      g041u=g1b+(n1*(x041b*.0013678))
      g051u=g1b+(n1*(x051b*.000073))
      g061u=g1b+(n1*(x061b*.0009323))
      g071u=g1b+(n1*(x071b*.0013678))
      g081u=g1b+(n1*(x081b*.0058307))
      g091u=g1b+(n1*(x091b*.0002207))
      g101u=g1b+(n1*(x101b*.0010763))
      g111u=g1b+(n1*(x111b*.0008252))
      g121u=g1b+(n1*(x121b*.0019265))
      g131u=g1b+(n1*(x131b*.0100118))
      g141u=g1b+(n1*(x141b*.0006841))
      g151u=g1b+(n1*(x151b*.0010758))
      g161u=g1b+(n1*(x161b*.0067993))
      g171u=g1b+(n1*(x171b*.0001802))
      g181u=g1b+(n1*(x181b*.0000376))
c
c Compute the total projected requirement if the factor is overestimated by
c 25%, overseas accounts.
c
      g012o=g2b-(n2*(x012b*.0078395))
      g022o=g2b-(n2*(x022b*.0067718))
      g032o=g2b-(n2*(x032b*.0013843))
      g042o=g2b-(n2*(x042b*.0013843))
      g052o=g2b-(n2*(x052b*.0000738))
```

```
      g072o=g2b-(n2*(x072b*.0013843))
      g082o=g2b-(n2*(x082b*.0059027))
      g092o=g2b-(n2*(x092b*.0002235))
      g102o=g2b-(n2*(x102b*.0010898))
      g112o=g2b-(n2*(x112b*.0008352))
      g122o=g2b-(n2*(x122b*.0019499))
      g132o=g2b-(n2*(x132b*.0101277))
      g142o=g2b-(n2*(x142b*.0006929))
      g152o=g2b-(n2*(x152b*.0010895))
      g162o=g2b-(n2*(x162b*.0068835))
      g172o=g2b-(n2*(x172b*.0001824))
      g182o=g2b-(n2*(x182b*.0000381))
c
c Compute the total estimated requirement if the factor is underestimated by
c 25%, overseas accounts.
c
      g012u=g2b+(n2*(x012b*.0078395))
      g022u=g2b+(n2*(x022b*.0067718))
      g032u=g2b+(n2*(x032b*.0013843))
      g042u=g2b+(n2*(x042b*.0013843))
      g052u=g2b+(n2*(x052b*.0000738))
      g072u=g2b+(n2*(x072b*.0013843))
      g082u=g2b+(n2*(x082b*.0059027))
      g092u=g2b+(n2*(x092b*.0002235))
      g102u=g2b+(n2*(x102b*.0010898))
      g112u=g2b+(n2*(x112b*.0008352))
      g122u=g2b+(n2*(x122b*.0019499))
      g132u=g2b+(n2*(x132b*.0101277))
      g142u=g2b+(n2*(x142b*.0006929))
      g152u=g2b+(n2*(x152b*.0010895))
      g162u=g2b+(n2*(x162b*.0068835))
      g172u=g2b+(n2*(x172b*.0001824))
      g182u=g2b+(n2*(x182b*.0000381))
      return
      end
```

Appendix E: Workload Factor Relationships and Sensitivity Coefficients

Workload Factor	Sensitivity Coefficient CONUS	Sensitivity Coefficient Overseas	FAC(s) Directly Affected	FAC(s) Indirectly Affected
1. Receipts	.0028447	.0078395	4121 4122 4124	4100 4120 4131 4132 4133
2. Turn-Ins	.0027024	.0067718	4121 4123 4124	4100 4120 4131 4132 4133
3. Issues	.0013678	.0013843	4123	4100 4120 4131 4132 4133
4. Shipments	.0013678	.0013843	4123	4100 4120 4131 4132 4133
5. Item Records	.000073	.0000738	4133 4162	4100 4130 4131 4132 4133 4160
6. Reparables	.0009323	N/A	4124 (CONUS only)	4100 4120 4131 4132 4133
7. DOR(s)	.0013678	.0013843	4123	4100 4120 4131 4132 4133

Workload Factor	Sensitivity Coefficient CONUS	Sensitivity Coefficient Overseas	FAC(s) Directly Affected	FAC(s) Indirectly Affected
8. OCCR(s)	.0058307	.0059027	4132 4151	4100 4130 4131 4132 4133 4150
9. Trans-actions	.0002207	.0002235	4131 4134 4152A 4161C	4100 4130 4131 4132 4133 4150 4152 4160 4161A
10. Bench Stock Issues, DORs and DOUs	.0010763	.0010898	4152B	4100 4131 4132 4133 4150 4152
11. Line Items Issued by BSSS/TIC	.0008252	.0008352	4153A	4100 4131 4132 4133 4150
12. Line Items Issued by IEU	.0019265	.0019499	4153B	4100 4131 4132 4133 4150
13. Entries on AF Form 600	.0100118	.0101277	4154	4100 4131 4132 4133 4150

Workload Factor	Sensitivity Coefficient CONUS	Sensitivity Coefficient Overseas	FAC(s) Directly Affected	FAC(s) Indirectly Affected
14. Requisitions	.0006841	.0006929	4141C	4100 4131 4132 4133 4140 4141A
15. Local Purchase Requisitions	.0010758	.0010895	4141C	4100 4131 4132 4133 4140 4141A
16. MICAP Starts	.0067993	.0068835	4142	4100 4131 4132 4133 4140
17. DCCs Produced	.0001802	.0001824	4163	4100 4131 4132 4133 4160
18. Units Counted (Inventory)	.0000376	.0000381	4164	4100 4131 4132 4133 4160

Appendix F: Project Plan

JOB #: 830204-50

PROJECT PLAN

SBSS MANPOWER IMPACT POLICY ASSESSMENT MODEL

PROJECT NUMBER: LS830204ST

APPROVED: 12 JAN 1984

KEITH E. BURRES, Colonel, USAF
Commander

AIR FORCE LOGISTICS MANAGEMENT CENTER

GUNTER AIR FORCE STATION, ALABAMA 36114

JOB NUMBER: 830204-50

SBSS MANPOWER IMPACT POLICY ASSESSMENT MODEL

PROJECT PLAN

PROJECT NUMBER: LS830204ST

SOURCE: HQ USAF/LEYS

PROJECT MANAGER: Capt Randy L. Moller

TEAM MEMBERS: Capt Burleson, AFIT
Capt Abney, AFIT
Maj Blazer, AFLMC/LGS

SPONSOR: HQ USAF/LEY; Lt Col Lombardi, HQ USAF/LEYS

OBJECTIVES: The result of this project will be a model which can be used to:

1. Assess manpower impacts due to workload, policy or procedure changes. Potentially, the model could be applied at USAF, MAJCOM, base-level, and AFLMC. For example:

a. USAF could predict the impact of a change in supply policy and relate these changes to Supply manning.

b. MAJCOM could possibly predict a manpower change from introduction of a new wing into the command much like LCOM is used in maintenance.

c. A base-level Chief of Supply could use the model to determine how a local change in procedures or organization will affect his manning.

d. AFLMC could determine the manpower inputs of proposed policy and procedural changes as a result of analysis for our project.

2. Provide general level estimates of future manpower requirements that can be used as inputs to the USAF POM process.

BACKGROUND: This project came to us as one of a package of proposed projects from HQ USAF/LEY. This model is needed because currently Supply workload

policy and procedure changes are made without an adequate means of determining the effect these changes will have on retail supply manpower requirements. The assessment model will analyze the impact workload policy and procedural changes will have on manpower numbers and costs.

SCOPE: The model can potentially be used at HQ USAF, MAJCOM and base levels to predict supply manpower changes.

ASSUMPTIONS AND CONSTRAINTS: This model uses current manpower standards. Therefore, it will be of limited use in an instance where there is no manpower standard for the task. Because it is rare that a task wouldn't have a manpower standard, this is not a significant problem.

METHODOLOGY AND DATA SOURCES: The project is being conducted by two AFIT students as their Master's Thesis. Their approach is to take the manpower equations in the Air Force Manpower Standards and introduce a factor to indicate an estimated increase or decrease in productivity. When the workload factor is inserted into the equation, the result is divided by the Man-Hour Availability Factor. This gives the number of personnel needed. The cost of the manpower will be determined by internally stored tables or mathematical equations. The assessment model will be developed initially for calculations for one base and then expanded for use with all bases. The manpower standards and expertise in their development and use will be provided by AFMSMET, Wright-Patterson AFB. Workload factor came from the bases M-32 and will be provided from the AFLMC's M-32 data base.

RESOURCES REQUIRED: The bulk of this effort will be performed by two AFIT students. The AFLMC resources required will be used to monitor their

progress. Approximately $3840 will be needed to travel to Wright-Patterson for face-to-face meetings with the students. Personnel will also be required to provide information, test the model, approve the report and manage the the project. Total manhours is estimated to be 269.

Milestones: These are the AFLMC milestones for this project.

Milestones	Estimated Start Dates	Estimated Completion Dates
Provide information and guidance	10 Nov 83	24 Aug 84
Analyze and Operate model	27 Jul 84	31 Aug 84
Review Report	3 Sep 84	7 Oct 84
Insure proper documentation	10 Aug 84	14 Oct 84

Milestone Description:

a. Information and guidance: AFLMC guidance to the AFIT students via telecon and TDY visits. In addition a data tape with supply workload factors (from our Supply Management Report Data Base) will be provided.

b. Analyze and operate model: This model will be validated by the AFIT students and by the AFMSMMET manpower personnel at Wright-Patterson. The model is not a "simulation" but actually in automating current manpower standards. Therefore validation can be and should be made by AF manpower personnel. Our involvement will actually be to load and operate the model locally.

c. Review report: Review the AFIT thesis and insure completeness, accuracy and documentation from a future user standpoint.

d. Insure proper documentation: Insure completeness from a user standpoint.

SBSS MANPOWER IMPACT POLICY ASSESSMENT MODEL

PROJECT ACTIVITIES/MANPOWER REQUIREMENTS

ACTIVITY/MANPOWER SUMMARY

ACTIVITIES	PERSONNEL	MANHOURS
Provide Information and Guidance	2 Supply	136
	1 Programmer	32
	ACTIVITY TOTAL	168
Analyze and Operate model	1 Supply	10
	2 Data Analyst	38
	ACTIVITY TOTAL	48
Review Report	2 Supply	8
	ACTIVITY TOTAL	8
Insure Proper Documentation	1 Supply	24
	ACTIVITY TOTAL	24
Project Management	1 Supply	45
	ACTIVITY TOTAL	45

PERSONNEL TOTALS

	Maj Blazer (LGS)	84
	Capt Moller (LGS)	161
	Analyst	16
	Programmer	32
		293

TOTAL PROJECT MANHOURS: 293

TOTAL PROJECT ELAPSE TIME: 9 Calendar Months

Attachment 1

TDY REQUIREMENTS/COSTS

Place	Trips	Days Including Travel	Travel Cost	Per Diem	Total
Wright-Patterson	4	8	2800	1040	3840
TOTALS	4	8	2800	1040	3840

Attachment 2

Appendix G: Results of Model Verification

	CONUS		Overseas	
FAC	AFMSMMET Calculations	MIAM	AFMSMMET Calculations	MIAM
4100	3.4	3.4	3.5	3.5
4120	2.1	2.1	2.3	2.3
4121	8.0	8.0	8.1	8.1
4122	13.1	13.1	17.6	17.6
4123	18.7	18.7	18.9	18.9
4124	20.7	20.7	23.5	23.5
4130	2.3	2.3	2.4	2.4
4131	1.8	1.8	1.8	1.8
4132	1.4	1.4	1.5	1.5
4133	4.0	4.0	4.1	4.1
4134	2.6	2.6	2.6	2.6
4140	2.2	2.2	2.2	2.2
4141A	1.0	1.0	1.0	1.0
4141B	5.2	5.2	5.3	5.3
4141C	7.8	7.8	7.9	7.9
4142	7.8	7.8	7.9	7.9
4150	2.4	2.4	2.4	2.4
4151	1.5	1.5	1.5	1.5
4152	.9	.9	.9	.9
4152A	13.7	13.7	13.9	13.9
4152B	5.9	5.9	5.9	5.9
4153	1.0	1.0	1.0	1.0
4153A	4.1	4.1	4.1	4.1
4153B	6.7	6.7	6.8	6.8
4154	8.6	8.6	8.7	8.7
4160	1.1	1.1	1.2	1.2
4161A	1.1	1.1	1.1	1.1
4161C	4.4	4.4	4.4	4.4
4162	4.3	4.3	4.4	4.4
4163	1.4	1.4	1.4	1.4
4164	2.9	2.7	2.9	2.9

To insure impartiality and add to the credibility of this validation, the Air Force Manpower Supply, Maintenance, Munitions Engineering Team was enlisted to aid in the verification. Using the data set provided, they assisted in calculating

by hand the required manpower figures which were rounded to the nearest tenth. These were then compared to the calculations made by the MIAM which was temporarily modified to print the results out to the nearest tenth. As can be seen from the figures on the preceding page, the MIAM produced identical results.

Data Sets Used in Model Verification

Workload Factor	Data
Receipts	6200
Turn-Ins	2900
Issues	13000
Shipments	1500
Item Records	73000
Reparables	2600
DORs	3200
OCCRs	300
Transactions	103000
Bench Stock--Issues + DORs + DOUs	3600
BSS/TIC Issues	4000
IEU Issues	2500
AF Fm 601s Processed	500
Requisitions (-LP)	7100
LP Requisitions	700
MICAP Starts	700
DCCs	5000
Units Inventoried	50000

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10. -----. Supply Management and Procedures. AFMS 4130. Washington: HQ USAF, 3 August 1981.

11. -----. Supply Management Analysis. AFMS 4131. Washington: HQ USAF, 3 August 1981.

12. -----. Supply Training Section. AFMS 4132. Washington: HQ USAF, 3 August 1981.

13. -----. Supply System Procedures and Standardization. AFMS 4133. Washington: HQ USAF, 25 September 1981.

14. -----. Supply Funds Management. AFMS 4134. Washington: HQ USAF, 3 August 1981.

15. -----. Supply Material Management. AFMS 4140. Washington: HQ USAF, 10 June 1980.

16. -----. Supply Stock Control. AFMS 4141A. Washington: HQ USAF, 27 June 1980.

17. -----. Supply Requirements. AFMS 4141B. Washington: HQ USAF, 27 June 1980.

18. -----. Supply Requisitions. AFMS 4141C. Washington: HQ USAF, 2 July 1980.

19. -----. Supply MICAP Management. AFMS 4142. Washington: HQ USAF, 3 July 1980.

20. -----. Supply Customer Support. AFMS 4150. Washington: HQ USAF, 3 August 1981.

21. -----. Supply Customer Liaison. AFMS 4151. Washington: HQ USAF, 3 August 1981.

22. -----. Supply Material Support. AFMS 4152. Washington: HQ USAF, 3 August 1981.

23. -----. Supply Demand Processing. AFMS 4152A. Washington: HQ USAF, 9 September 1983.

24. -----. Supply Bench Stock Support Unit. AFMS 4152B. Washington: HQ USAF, 3 August 1981.

25. -----. Supply Retail Sales. AFMS 4153. Washington: HQ USAF, 3 August 1981.

26. -----. Base Service Store. AFMS 4153A. Washington: HQ USAF, 9 September 1983.

27. -----. Individual Equipment Unit. AFMS 4153B. Washington: HQ USAF, 9 September 1983.

28. -----. Supply Allowance and Authorization. AFMS 4154. Washington: HQ USAF, 25 September 1981.

29. -----. Supply Systems Management. AFMS 4160. Washington: HQ USAF, 9 July 1980.

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34. -----. Supply Document Control. AFMS 4163. Washington: HQ USAF, 25 September 1981.

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VITA

Captain Larry D. Abney was born on 21 February 1951 in Dayton, Ohio. In 1968, following his junior year in high school, he entered Georgetown College in Georgetown, Kentucky. He received the degree of Bachelor of Arts in English in May 1972. Following graduation he served as a hospital administrator for the Commonwealth of Kentucky in Lexington, Kentucky. In 1973, he joined the Parker Seal Company, Berea, Kentucky, as a production manager. In 1977, he became a secondary English teacher for the Laurens County School System, Dublin, Georgia. He coached varsity football and tennis and taught English there until 1979 when he received a commission in the USAF through the OTS program. He completed missile launch officer training and was certified in September 1979. He served as a missile launch officer in the 740 SMS, Minot AFB, North Dakota, until August 1980. He was then assigned as the 91 CSG, Minot AFB, Executive Officer until January 1981. He served as the 91S UPS Executive Officer at Minot AFB until March 1982. During this time, he was named 15 AF Administrator of the Year for 1981. In March 1982, he was chosen to command the 91 SMW Headquarters Squadron Section. He served at Minot in this capacity until entering the School of Systems and Logistics, Air Force Institute of Technology, in May 1983.

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VITA

Captain Robert E. Burleson was born on 9 April 1954 in Oneida, New York. He graduated from high school in Oneida, New York, in 1972 and attended Mohawk Valley Community College until June 1974. In October 1973, he enlisted in the USAF. His first assignment was with the 42nd Supply Squadron, Loring AFB, Maine, in the Supplies Management Office. While at Loring, he attended Ricker College from which he received a Bachelor of Science degree in Business Management in April 1977. In January 1977, he entered training at the Officers Training School, Lackland AFB, Texas, and received a commission in April of that same year. His first duty assignment as an officer was with the 666th Radar Squadron, Mill Valley AFS, California, as a Station Support Officer. Subsequent to that he served as the Chief, Management and Procedures Branch, 410th Supply Squadron, K. I. Sawyer AFB, Michigan. He entered the School of Logistics, Air Force Institute of Technology in May 1983.

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